9-30-2011

The Instructional Practices of K-8 Teachers with Interactive Whiteboards: A Descriptive Case Study

Corey Udell Johnson

THE INSTRUCTIONAL PRACTICES OF K-8 TEACHERS WITH INTERACTIVE WHITEBOARDS: A DESCRIPTIVE CASE STUDY

by

Corey Udell Johnson

A Dissertation

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Doctor of Education

Major: Instruction and Curriculum Leadership

The University of Memphis

December 2011

Dedication

I want to thank God for guiding me to this point in my life. To my wife India and son Corbin, for the many sacrifices they have made during this process. To my parents, Myrtis and Purvis, for their love and support. To my brothers Christopher and Cordney, thank you for paving the way. To Dr. Courtney Harris, thank you for setting an example. Thank you all for your love, support and encouragement.

Acknowledgements

Dr. Lee Allen, you have guided me through this process. Thank you for offering an open hand when I was falling and an iron fist when I was failing. The members of my dissertation committee, Dr. Deborah Lowther, Dr. Louis Franceschini and Dr. Cliff Mims, generously gave their time and expertise to improve my work. Thank you for your contributions and genuine support. Finally, I want to thank David Carlisle whose assistance made this moment possible.

To my family and friends who I have abandoned, neglected, or forgotten, I will emerge from this process a better man and I pray you welcome me back with opened arms.

Abstract

Johnson, Corey Udell. Ed.D. The University of Memphis. December/2011. The Instructional Practices of K-8 Teachers with Interactive Whiteboards: A Descriptive Case Study. Major Professor: Lee Edward Allen.

The interactive whiteboard (IWB) has become an established component in K-12 classrooms. Although multimedia features are incorporated in interactive whiteboards, research has provided mixed results on teachers' strategic use. This study addressed the following questions: 1) What instructional strategies were observed in a sample of classrooms equipped with IWB technology and how they compared to CREP norms?; 2) How were the interactive whiteboards observed being used in the sample classrooms implementing IWB technology?; and 3) What levels of concern, attitudes, and perceptions did teachers indicate toward IWB implementation and use in the sample classrooms?

Strategies used by 19 teachers to implement the affordances of interactive whiteboard technology into their teaching practices were examined. Levels of teacher concerns towards the implementation of IWB technology were also identified. Multi-class observations were used to capture the overall use of instructional strategies by teachers with interactive whiteboards. Teacher demographics included grade levels, subject areas and years of teaching experience. Observation and survey methods were used to collect data. The School Observation Measure (SOM), Stages of Concerns Questionnaire (SoCQ), IWB Teacher Activity Observation Tool, and a Teacher Evaluation Survey were used to gather quantitative and qualitative data. Descriptive statistics were

calculated for all variables. Raw scores were converted to percentages to develop SoCQ profiles.

Results indicated that levels of student engagement were low when compared to normed data. Teachers in initial stages of IWB implementation used direct instruction and act as coach/facilitator as instructional strategies more often than other strategies. During the initial stages, basic office applications were used more often than the unique affordances of IWB systems. Intensity levels of concerns toward collaboration during the initial stages of IWB adoption were high. In addition, the emergence and resolution of concerns about IWB appear to follow developmental patterns indicated in previous research studies.

Table of Contents

List of Tables

Chapter 1

Introduction

"*There is nothing wrong with change, if it is in the right direction " (Winston Churchill).*

The use of interactive whiteboards (IWB) may be the most significant change in the K-12 learning environment in the past decade (Higgins, Beauchamp, & Miller, 2007; Slay, Sieborger, & Hodgkinson-Williams, 2008). The IWB is a stable, yet underused component in many K-12 classrooms. The novelty associated with this device is frequently coupled with the assumption that its use will increase the achievement of students. However, the manner in which this technology is used to foster increases in student achievement is inconsistent with some recommended pedagogies. Before the outcomes of technology integration can be studied, there must first be a clear understanding of how teachers and students are using the technology (Bebell, Russel, & O'Dwyer, 2004). "*A New Foundation for 21st Century Learning,*" a policy statement published by the Whitehouse's Department of Education Office of Science and Technology Policy (OSTP), affirms the 2011 budget will make a strong commitment to technology, which transforms how educators teach and how students learn (Executive Office of the President, 2010). This may indicate the need for teachers to play a more active role in determining how IWB technology is used because their role has become more important as the push for integration of technology increases.

Researchers have highlighted the role of interactive whiteboards in pedagogic practice (Kennewell & Beauchamp, 2007; Smith, Hardman, & Higgins, 2006). An emerging theme from these studies was the recurring observation of superficial interactions with the IWB and the degree to which the IWB was used to support whole-class teaching as opposed to traditional methods of instruction. Current instructional practices and professional development must be analyzed and recorded to reduce the occurrence of non-prescriptive interactions and reinforce the necessity for whole class teaching methods with IWB technology (Miller & Glover, 2006; Miller & Glover, 2007).

The functionality of an interactive whiteboard is based on the combination of three main devices: A digital touch-screen board, a computer, and a digital projector. This combination creates a resource that encompasses various media in a single source to be used for instructional enhancement. The computer is linked to the data projector and the touch-screen board, which both shows the image projected from the computer and allows input from a stylus, hand interactions or other peripheral devices. Software runs in conjunction with the IWB components allowing the user to interact digitally with the items displayed on the screen.

The most productive and meaningful uses of technology engages learners in knowledge construction, conversation, articulation, collaboration, and reflection (Jonassen, 1995). IWB technology provides teachers with a single resource that may enhance instructional environments. IWB technology has the potential to be engaging and motivating to learners, while providing a medium for collaboration

and reflection to assist in knowledge construction. These affordances are dependent on the teachers' ability to use the functionality of the device as well as their instructional practices, beliefs and techniques (Cogill, 2002; Glover & Miller, 2002). The use of information and communication technology has a limited impact on teaching and learning when teachers fail to recognize that interactivity requires a new approach to pedagogy, lesson planning and the curriculum (Cox et al., 2004; Schmid, 2008).

Smith et al. (2006) suggested the rate of interaction between teacher and learner tends to increase when an IWB was used, although this did not necessarily lead to improvements in student attainment. In addition, Smith et al. contended that a misconception was the mere presence of the board enhanced the learners' motivation, promoting inquiry and interest in the subject of the lesson. This was not a shared view by researchers. Beauchamp and Kennewell, (2009) claimed that expert orchestration of resources was the key factor in converting interactions into learning. The possibility for increased student attainment decreases when interactions with IWB technology do not involve effective facilitation and guidance. Haldane (2007) stressed the importance for teachers to recall and understand that the digital whiteboard in itself was not and cannot be "interactive" it is merely a medium through which interactivity may be afforded. However, these affordances may be based on the teachers' ability to integrate, manage and facilitate the functions of the IWB.

Whether a teacher's pedagogy prescribes to traditional or interactive methodology, their role in the learning environment does not change. The

teacher's role is vital in student attainment and should remain the central focus in the learning environment (Holland, 2001). IWBs do not determine pedagogy as standalone devices. The level of interaction generated depends on the way they are used, in particular, the teachers' ability to orchestrate the affordances and constraints of the context (Tanner, Kennewell, Jones, & Beauchamp, 2005). However, the use of technology, such as the IWB, may have a limited impact on teaching and learning where teachers fail to appreciate that interactivity requires a new approach to pedagogy, lesson planning and curriculum. Deubel (2007) contends that instructional methods cause learning; the medium does not.

The National Center for Technology in Education suggested that optimal interactive whiteboard use involved both teacher and student use (National Center for Technology in Education, 2008 p.1). Recommended strategies included:

- Allowing the presentation of student work in a more interactive and collaborative way;
- Showing video clips that explain difficult concepts (in any curricular area);
- Demonstrating how an educational software program works, e.g., an art program with students using their fingers and hands to draw rather than working with a mouse;
- Catering more effectively for visually impaired students and other students with special needs;
- Displaying Internet resources in a teacher-directed manner;

- Creating handwritten drawings, notes and concept maps during class time, all of which can be saved for future reference.

Statement of the Problem

The existing capability of the educational system for developing, identifying, and implementing effective and innovative practices has been limited. In addition, current programs have not been sufficiently well structured to infuse technology across program areas and agencies to enable educators and policy makers to identify the most effective practices to replicate (Executive Office of the President, 2010). The integration of interactive whiteboards has increased significantly in recent years. However, integration of this resource has produced limited results in terms of student achievement. This may be attributed to the availability of professional development that allows teachers to envision how technology can support their teaching. This study focused on the pedagogy used by teachers in conjunction with the interactive whiteboards in K-8 classrooms. Additionally, this study focused on the ways the technology was used.

Background of the Study

The presence of IWB technology in K-12 classrooms has increased significantly over the past 10 years. This increase was attributed to the seemingly limitless possibilities prematurely associated with the installation of the equipment and initial training offered for this technology. Interactive whiteboards were considered a gateway to a more interactive style of whole class teaching. The touch sensitive screen encouraged pupil interaction while enabling the more flexible use of a broad range of multimedia resources.

In an effort to increase student achievement through increased student engagement, the campus under study implemented a plan to install an interactive whiteboard in all 50 of its classrooms. The goal of this initiative was to enhance student learning by increasing student engagement in the learning process using high tech, high interest teaching tools. To achieve this goal, a financial grant for matching funds was acquired from a local education foundation to supplement funding generated through the Parent Teacher Association. The initial stage of implementation equipped sixteen classrooms with interactive whiteboard technology.

Along with the physical installation of the IWB technology, teachers participated in various professional development sessions throughout the year. Teachers were also encouraged to collaborate and share their instructional experience and insight on the use of the new technology with coworkers and fellow teachers in the school district. A corporate partner agreed to offer unlimited training (on-line and on-site) for the teachers at no future cost and also agreed to provide the campus with a full site license for the RM EasyTeach ™ software. This software is a collection of content-rich educational software products, designed for interactive whiteboards, which provide a wide range of cross curricula teaching tools. The EasyTeach suite includes features that were ideal for whole class teaching purposes. Features include multi-lingual and multi-device capabilities giving users the opportunity to overcome language barriers and use the resources regardless of what equipment is used in the school. In addition to a pre-developed multimedia lesson bank, audio, video, and text-to-

speech options were accessible and could easily be incorporated into existing lessons. The school district scheduled staff development training sessions on IWB at the campus under study in order to extend the benefits of this technology throughout the district. These efforts were intended to extend the benefits of the campus's experiences to future teachers and other in-service teachers throughout the area.

While the campus's Tennessee Comprehensive Assessment Program (TCAP) achievement test scores where consistently above the state and system averages, there was room for improvement in social studies and science. The school's 2009 TCAP scores in science had a mean NCE Gain over Grades Relative to Growth Standard of -1.3 over grades 4-8 compared to the state's gains of 0.2. TCAP scores in social studies showed a mean NCE Gain over Grades Relative to Growth Standard of 1.3 over grades 4-8 compared to the state's gains of 1.1. Neither of these scores was considered low, however they both allowed room for growth.

The use of the IWBs to move these test scores forward was a goal of the project. Teachers responsible for these subject areas were tasked with expanding on the methods used to present lessons. The goal was to provide students with opportunities for creative problem solving and collaborative activities. Because IWB technology allows teachers to seamlessly shift from onscreen-projected Internet sites to classroom text or other materials on the whiteboard, simultaneously to help students make connections between these different sets of materials, the teachers felt the technology would help them more

effectively engage students in social studies and science content. Students were able to digitally draw or write answers directly on the board, or use a hand-held slate to interact with the board.

Setting

The campus under study applied for matching funds from a local education foundation to equip 16 classrooms with interactive white board technology. The goal of this effort was to enhance student learning by increasing student engagement through the use of highly technical, highly interactive teaching tools. The initial 16 classrooms were equipped with an interactive white board, Wacom tablet, EasyTeach software, and a ceiling-mounted digital projector. The installation of these 16 systems was the first phase of a campus-wide initiative to equip all 50 of the research campus's classrooms with interactive white board systems.

The campus developed partnerships with area universities and a local communication company to leverage their investments and fulfill funding requirements set forth by the local education foundation. The partnering communication company agreed to provide unlimited training, both online and onsite, for the teachers with access to the IWB technology. The campus also acquired three additional interactive whiteboards through this partnership. A full site license for the EasyTeach software was provided at a discounted rate.

The initial group of teachers who received the IWB packages was selected based on their technology skills and eagerness to learn and use the new technology. Social studies and science were selected as curricular focus areas.

Fifth grade was selected as the target year because of the daily classroom rotation system implemented at that grade level. In addition, departmentalized teachers in grades K-8th were selected to capture comparative experiences of students in various age groups and curricular areas.

This campus had a tradition of experimenting with different resources to meet the needs of learners. The use of technology was often the focus of efforts to advance student achievement. This campus was the first in its district to launch a laptop initiative. This campus was also the first and only campus in its district to offer an intelligent math tutoring system. This system was expanded to all 5th-8th-grade students through a separate project that was also partially funded through the local education foundation.

Purpose of the Study

The purpose of this study was to investigate the perceptions and attitudes of a select group of teachers toward the implementation of interactive whiteboards. Strategies teachers used with the technology and the associated uses of IWB affordances were also investigated.

Research Questions

The following research questions guided the study:

1. What instructional strategies were observed in a sample of classrooms equipped with IWB technology and how they compared to CREP norms?
2. How were the Interactive whiteboards observed being used in the sample classrooms implementing IWB technology?

3. What levels of concern, attitudes, and perceptions did teachers indicate toward IWB implementation and use in the sample classrooms?

Significance of Study

The intent of this study was to analyze the new trend of interactive whiteboard investment with an emphasis on the strategies used by teachers to implement interactive whiteboard technology into their teaching practices. This research study was designed to indicate the strategies teachers used to support a whole class-learning environment with an interactive whiteboard. This study was also designed to provide information about teachers' perceptions and concerns toward the use of interactive whiteboards. Emerging themes from this study will be analyzed to determine how teachers incorporated the affordances of IWB technology into their lessons and pedagogical practices.

This study was used to evaluate the effectiveness and efficiency of IWB investments. This study would potentially assist teachers by providing a prescription for effective use of IWB technology in classrooms. The frequency of strategies used by teachers to promote the whole class-learning environment may be used to generate a model for effective professional development and continued instructional support. This support may be established through effective professional development geared toward changing the ways teachers use interactive pedagogical practices.

The research findings were not generalized toward all K-8 schools as a whole; however, the positive and negative variables influencing the effective use of IWBs in the scope of the sample were highlighted. Implications for this study

range from reform of professional development practices to policies pertaining to technology integration, implementation and curriculum development.

Limitations of Study

At the time of this study, the use of interactive whiteboard technologies in K-12 school districts was still considered to be in an early stage of implementation. Although research regarding the use of IWB tools and resources for instruction and learning existed, there was little actual data to support its use as a variable to increase student achievement. A secondary limitation of this study was based on the small sample size of participants; generalizations were not made in regards to the general population. The teachers who participated in this study were selected based on their current technology skills and their eagerness to learn and use new technology. Every teacher involved in this study had full access to IWB technology in his or her classrooms. The majority of teachers in the general population may not have had access to or were required to share IWB resources. Therefore, the emerging themes from this study may not have reflected the opinions of or strategies used by these teachers.

Standardized test scores for this school were consistently above the state and system averages. However, there was opportunity for improved scores in specific core areas. Therefore, it may have been difficult to gauge how significant the use of interactive whiteboards would have been in increasing the levels of student achievement.

The population in which the sample was drawn also presented limitations to this study. This school was considered to be in a district that was financially

secure and highly equipped with instructional technology resources. For these reasons, this school district was unique when compared to most of the schools in the district. Therefore, generalization across school districts in the state may have been limited because of:

1. Variations in curriculum content
2. Variations in individual teaching strategies
3. Variations in access to instructional equipment
4. It is unclear whether all respondents understood the basic functionality of the IWB. This lack of understanding deserves further investigation as the premature use of this technology may hinder learning and decrease student achievement.
5. This study focused on whole group data; therefore, there was a lack of demographic data on teacher age and degree field. This data could prove beneficial in understanding how teacher-training programs affect income and existing teachers' technology skills.
6. The length of time used for data collection only allowed for a snap shot of the teacher concerns and levels of IWB use at a single point in time.
7. The data collected could have been more concise in the gathering stage, which could narrow down the focus, producing more specific and accurate results.

This study focused on some of the factors that contributed to the use of interactive whiteboard technology as were suggested by teachers within previous

studies (Gillen, Staarman, Littleton, Mercer, & Twiner, 2007; Hennessy, Deaney, Ruthven, & Winterbottom, 2007; Hodge & Anderson, 2007).

Overview of the Methodology

A holistic single case study design was used for this study. This study only examined the global nature of the campus as opposed to the individual teachers within the organization. Validated survey and observation instruments served as the critical data sources in the comprehensive study. Data sources for this study were the University of Memphis-affiliated Center for Research in Educational Policy (CREP): the School Observation Measure (SOM), and the Stages of Concerns Questionnaire (SoCQ) developed by the Southwest Educational Development Laboratory (SEDL). The data were obtained through multi-class observations and by using online collection methods. Secondary data sources included the IWB Teacher Activity Observation Tool, a list of observable IWB affordances that was used to measure their frequency of use. This list was based on a compilation of affordances offered from various IWB manufacturers. A self-assessment survey developed and distributed by the campus was also used to support the findings from the stages of concerns questionnaire. The purpose of this survey was to provide teachers the opportunity to assess both the professional development they have received as well as their own perceptions, understanding and use of the IWB affordances.

Convenience sampling was used to generate the sample for this study. Participants were selected based on the available population of teachers who have the interactive whiteboard technology installed in their classroom. The

School Observation Measure (SOM) was used to document and record the observed strategies used by teachers in the classroom. In addition, the Stages of Concerns Questionnaire was used to assess the concerns of those teachers who used interactive whiteboards for instructional purposes.

Chapter 2

Review of Literature

Introduction

This chapter reviews findings, relative to the current research questions, from the available body of literature. The first section provides a theoretical examination of learning theories, current and recommended strategies for teacher use in conjunction with IWB technology. The second section examines the factors shown to influence technology integration in classrooms and the qualities associated with interactive whiteboard technology listed from empirical research. The final section provides an examination of teacher concerns, in terms of their attitudes and perceptions toward the use of interactive whiteboard technology in their classrooms.

Use of interactive whiteboards is often accompanied by the promise of increased student achievement; however, current research has not provided a solid foundation to reinforce this claim. Increasing technology use can create a vehicle through which educators can address teaching and learning opportunities for all students (Rakes, Fields, & Cox, 2006). Researchers have suggested the use of interactive whiteboards can increase student engagement and achievement (Kitson, Fletcher, & Kearney, 2007; Lopez, 2009; Schacter, 1999; Sivin-Kachala, Bialo, & Rosso, 2000; Smith et al., 2006), however; this is highly reliant on the pedagogical practices used by the teachers facilitating the lesson (Haldane, 2007). The effects of technology on student learning are often the focus of research efforts; however effects on learning must be placed in the

context of teacher and student use (Bebell et al., 2004). Although the use of interactive whiteboards may have the potential to increase student achievement, the body of available research to support this claim often yields mixed results.

In order for teachers to properly use and sequence the qualities of the IWB into their lessons, it is imperative that they understand what the qualities are. The interactive whiteboard (IWB) is a digital touch-screen board that can assist in the facilitation of various media when coupled with a computer and digital projector. Glover and Miller (2002) gave praise to the total package of IWB peripherals and attributes, indicating the sum of the entire unit is greater than its individual parts. Researchers suggested there were no absolute properties of an IWB that would enable the prediction of effective teaching or learning. Although student learning can be enhanced with the proper use of an IWB in the classroom, other variables must be considered while analyzing the effects of the IWB. Research provides mixed results in the direct indication of positive effects of the IWB on student learning (Machin, McNally, & Silva, 2007; Rakes et al., 2006).

Theoretical Literature

The use of interactive whiteboards has been supported by a number of learning theories, approaches and techniques. The most relevant of these are Social Constructivism and Active Learning. The constructivist approach to learning theorizes that people produce knowledge and form meaning based upon prior experiences and new information gained through exploration, inquiry and social interactions. These concepts are consistent with the use of interactive

whiteboards as the technology supports the construction of knowledge through teacher-pupil, pupil-pupil discourse, and active learning. Social Constructivism, as a philosophy of learning, evolved from the work of Vygotsky (1978). His theory focused on the interpersonal process of individual knowledge construction. This theory places the responsibility of learning with the learner as the teacher role is transformed from a purveyor of information to a facilitator of knowledge. Under the constructivist paradigm, knowledge is not a self-sufficient entity; knowledge is not directly transmittable from person to person, but rather is individually and idiosyncratically constructed or discovered (Liu & Mathews, 2005, p. 387). Radical constructivists emphasize learner-centered and discovery-oriented learning process where the social environment and social interaction work as stimulus for individual cognitive differences. This is consistent with Vygotsky's (1978) standpoint that social interactions are fundamental to learning. He stated "that instruction is most efficient when students engage in activities within a supportive learning environment and when they receive appropriate guidance that is mediated by tools" (p. 231). Interactive whiteboards can be used to implement these strategies. Through the use of IWB technology, teachers incorporate the use of interactivity as a stimulant for conceptual development and cognitive understanding (Glover, Miller, Averis, & Door, 2007). Supporting Vygotsky's model, Bell (2002) concluded that IWB use encouraged interactive and collaborative learning.

Active Learning is the process of keeping students mentally, and often physically, active in their learning through activities that involve them in gathering

information, thinking, and problem solving (Michael, 2006). Active learning is a process where students engage in higher-order thinking tasks. Proponents of active learning have also defined this strategy as any classroom learning activity, other than listening passively to an instructor's lecture that students are engaged in (Faust & Paulson, 1998). Teachers can incorporate the IWB to assist in the facilitation of higher-order thinking task, however, it is important that they understand how to utilize discussion and questioning techniques.

Tanner et al. (2005) describe whole-class teaching as highly interactive with the intention of promoting higher quality dialogue, discussion, and strategic thinking. Smith et al. (2004) conducted an investigation of the impact of interactive whole class teaching on the interaction and discourse styles of primary teachers while teaching literacy courses. The research concluded that effective teachers appeared to have a more interactive style as measured by the overall rate of discourse moves, using 13% more discourse moves than the rest of the sample. The use of IWB technology has a limited impact on teaching and learning where teachers fail to appreciate that interactivity requires a new approach to pedagogy, lesson planning and the curriculum (Cox et al., 2003; Hodge & Anderson, 2007). Wood and Ashfield (2008) concluded that interactions among teacher, pupil and technology necessitated more than the transmission of knowledge from either the teacher or technology to the pupil. This suggests that when using IWB technology the orchestration of these dialogues and transmission must be carefully structured to increase the opportunity for higher student attainment.

Interactive Learning Strategies

In the framework of social constructivism, interactive learning requires that students be dynamically engaged in lesson activities. Interactive learning incorporates a variety of educational strategies, including the use of visuals, reading and writing, discussing, and manipulating concepts. With effective planning, teachers can use the interactive whiteboard to satisfy each of these strategies. Smith et al. (2006) investigated teacher-student dialogue interactions in the context of interactive whole class teaching using the IWB. One hundred eighty-four literacy and numeracy lessons in the primary grades were observed over a two-year period. Using a computerized observation schedule, teachers were observed with and without an IWB. These researchers found that lessons using the whiteboards had more reciprocal dialogue, faster pace, and greater frequency of answers; however, the results were still not as extensive as those claimed by IWB advocates. Lerman and Zevenbergen (2007) reported the teachers using IWB spent a majority of on explanations and recitation type scripts. They also reported a faster pace in lessons, however, there was a decline in protracted answers from students with fewer episodes of teachers making connections or extensions on student responses.

Levy (2002) conducted research in secondary schools in Sheffield, England. A major focus of this study was the visual impact of whiteboard technology on the instructional practices utilized by teachers across the disciplines. The main objectives for this study were to identify how teachers used the boards, what worked, the perceived benefits of whiteboard use, and what

constituted good pedagogic practice. Finding suggested that interactive whiteboard use triggered more teacher-student interactions by encouraging discussion, questioning, and greater student participation in the lessons. Levy also stated that according to BECTA “High-quality direct teaching is oral, interactive and lively. It is a two-way process in which pupils are expected to play an active part by answering questions, contributing points to discussions, and explaining and demonstrating their methods to the class” (p. 1).

Instructional Efficiency

As a device, interactive whiteboards combine the functionality of traditional instructional components and tools that lend themselves to more alternative teaching practices. With access to this array of tools, it is imperative that teachers learn to properly sequence IWB qualities in an effort to use them in a more efficient manner. Instructional efficiency is defined as the level of performance attained per minute of total instructional time (Cates et al., 2003). Instructional efficiency is achieved through the teaching methods, activities and instructional materials designed to guide learning (Herschbach, 1992). Instructional efficiency has important implications for practitioners who often operate under instructional and/or curricular time constraints (Nist & Joseph 2008). Most instructors are not instructional designers; therefore, to increase the opportunities for student learning, the methods in which they sequence and use IWB technology should follow a valid framework.

The extent to which students are engaged in the learning process is dependent on the facilitators’ ability to organize the affordances of the equipment

and integrate these capabilities into their pedagogical practices. Researchers (Low & Sweller 2005; Mayer 2001, 2005; Moreno, 2007), indicated the most effective learning environments are those that combine verbal and non-verbal representations of the knowledge using a mixture of presentation modes. The IWB potentially affords interaction if the teacher perceives that it can be used in this manner, and uses appropriate software that also affords interaction. Armstrong et al. (2005) used an innovative case design utilizing video technology to capture, analyze and communicate the complex interactions between students, teachers and technology that occur in the classroom. During this study, teachers were able to fully integrate IWB technology into classroom practices, using it to support and enhance students' learning through discourse.

Armstrong et al. (2005) and Judson (2006) suggested that teachers were the key determinant of implementation, exercising the power to deny or inhibit the existence of technology in classrooms. These researchers suggested that teachers were the critical agents in mediating the software, the integration of the software into the subject aims of the lesson and appropriate use of the IWB to promote quality interactions and interactivity.

Recommended Strategies

Used properly, teaching strategies that include the integration of IWB technologies may provide a means of educational enhancement while bridging the divide between the classroom and real world problems. Teachers recognize the importance of integrating technology into their curricula; however, external and internal barriers often limit their efforts (Ertmer, 1999). Hodge and Anderson

(2007) contended that during the introductory stages of implementation, the IWB could have a negative effect on teaching and learning as teachers resort to lengthy, whole class teaching methods. Although students may be engaged in the lesson, it might be suggested that the opportunity to engage in individual activities to strengthen skills is overlooked because of the intriguing nature of the new technology. Interactive strategies may assist with maintaining student attention through engagement. Davison and Pratt (2003) proved that strategies involving movement by the teacher were more memorable than simply seeing screen presentations.

Researchers suggested various strategies to promote the effective use of media rich instructional technology. Ryan and Cowie (2009) proposed a sequence of activities that incorporated the use of IWB images. The IWB was used to present a series of large images of mold. These images were introduced after students had the opportunity to examine moldy bread without the aid of a microscope. Students were asked to describe what they saw and document the examination through drawings. This examination led to a group discussion of descriptive features of the mold. After the discussion, the students were directed to focus their attention on the IWB, where the teacher presented magnified images of the same mold, revealing a level of detail that students were not able to view through the naked eye. In this case, the use of the IWB promoted student curiosity and supported whole class learning. However, this use could have been accomplished using other media resources such as PowerPoint.

An important trend in research was the change of focus from describing and exploring the affordance of the technology to consideration of the development of the pedagogy of use (Higgins et al., 2007; Windschitl & Sahl, 2002; Wozney, Venkatesh, & Abrami, 2006). Data indicated that the use of IWB technology did not generate a fundamental change in the pedagogy of teachers. In contrast, Kennewell (2005) indicated that IWB technology reinforced traditional pedagogy. Miller, Glover, and Averis (2004) have provided evidence that effective pedagogical interactivity requires structured lesson planning, with stepped conceptual learning, pace in activities and a cognitive review, all of which provide opportunities for sustained use of a variety of IWB techniques.

Interactive whiteboards do not determine pedagogy by themselves. The level of interaction generated may depend on the extent in which they are used. Particularly, pedagogy is determined by the teacher's ability to orchestrate the affordances and constraints of the context through dialogue and the development of thinking and learning (Kennewell & Beuchamp, 2007; Richardson, 2002; Tanner et al., 2005). A common solution to converting interactions into learning may be the expert coordination of resources. Investigating how technology can be harnessed to facilitate orchestration by teachers and learners will guide teachers' efforts to improve learning through the use of ICT (Beuchamp & Kennewell, 2009).

Slay, Sieborger, and Hodgkison-Williams (2008) argued IWB technology was an effective tool for initiating the learning process. This perception was evident as Hodge and Anderson reported a shift in one teacher's strategy toward

IWB use. Initially, students were gathered around the board and engaged in a whole-class learning activity. This strategy resulted in idle learning in the form of educational entertainment for a majority of the students. The IWB was later used to introduce the lesson, which cut down on the lengthy whole-class lessons and provided more time for individual or small group activities.

Elements of Interactive Strategies

Interactivity

*Th*e rate of interaction between teacher and learners tends to increase when an IWB is used, although this does not guarantee improvements in student attainment (Smith et al., 2006). Researchers (Rudd, 2007; Somekh et al., 2002) have questioned the extent to which the interactive functionality of the technology, as opposed to the degree of interaction sequenced by the instructor, encourages greater interactivity during the lesson. Interactivity is not in and of itself, effective. However, interactive elements can be used to trigger the processing of central aspects of the learning materials (Atkinson & Renkl 2007; Somyurek, Atasoy, & Ozdemir, 2009). The digital whiteboard itself is not and cannot be, interactive; it is merely a medium through which interactivity may, to a greater or lesser extent, be afforded. Nevertheless, the technical qualities of an IWB are likely to influence the board user's choice of how information and messages will be presented.

Engagement

Beeland (2002) found that the use of an IWB as an instructional tool had an effect on student engagement. Results indicated a correlation between how highly the whiteboard was rated based on the type of media that was used.

Results from this study implied that the IWB could be used to increase student engagement during the learning process. However, to maximize the relevance of the technology, teachers must be experts in their fields and understand what affordance of the interactive whiteboard is best suited to assist in their instruction (Moss et al., 2007).

It is important that teachers understand what attributes work best with their subjects as the use of too many or extra utilities can impose extraneous cognitive loads on students (Van Marrienboer & Sweller, 2005). This may occur when the IWB is used for entertainment rather than instruction. A recurrent concern established by researchers is the novelty of the IWB eventually will wear out, causing students to lose interest in the material being presented (Beauchamp & Parkinson, 2005). However, if teachers are able to orchestrate different strategies and instructional techniques while incorporating the IWB in their lessons, this concern can be alleviated.

Pace

The pace of a given lesson determines the rate in which knowledge is generated cognitively. Researchers suggested the faster pace generated with IWB technology might limit the opportunities for pupil-teacher dialogue (Gillen et al., 2007). Researchers also indicated that the use of interactive whiteboards to maintain instructional pace could decrease the pupils' time for reflection and inquiry during the lesson (Hennessy et al., 2007; Jewitt, Moss, & Cardini, 2007). These studies indicated various IWB affordances used to increase the pace of whole class teaching: (a) use of pre-planned Power Points and flipcharts, (b)

preload and then move among a range of different materials, and (c) the ability to move easily between applications. However, the researchers also noted that allowing pupils to use the board affects the pace of whole class lessons. In addition, other researchers indicated the use of IWBs to control the pace of a lesson, provides teachers with a resource to support scaffolding strategies (Wood & Ashfield, 2008). Moss et al. (2007) suggested teacher-only operation of the IWB to avoid reducing pace through committing time for turn taking.

Teaching with Interactive Whiteboards

In the early stages of use, the IWB is commonly treated in the same manner as a traditional black/whiteboard. The IWB often serves to reinforce traditional pedagogies as teachers adjust to the new technology and begin to apply interactive concepts to their current instructional styles. During this period, interaction is often reduced as teachers restrict the use of the board to themselves, sometimes expressing concern that pupils might put the board into a state that they would not be able to undo due to technical ignorance (Beauchamp, 2004). At this stage, lecture formats are often utilized, however, Tanner et al. (2005) indicated that the lecture is the form of whole class teaching with the lowest level of interaction.

With careful planning, use of interactive whiteboards in instruction can incorporate the various learning modalities in ways that make learning more appealing. With well chosen and well-sequenced activities ready at the touch of a button, teachers are given more time to engage with pupils' learning (Gray et al., 2005). Lessons using the IWB can be structured to allow hands-on participation,

while encouraging reflection through whole class discussion. Interactive whiteboards can be used to display facts and data, sequence information, stream video clips, access real-time internet sites, graphics, animations, and diagrams. IWB technology can also be used to preview content, connect it to prior knowledge, and explore real-world applications. Visual learners benefit from seeing information displayed on a colorful, large format. Kinesthetic learners have the opportunity to write on, highlight, and interact with the IWB. Additionally, auditory learners can be accommodated through dialogue, sound effects, and oral stimulation.

Researchers have provided evidence supporting the appropriate use of technology to improve teaching practices and enhance student learning (Kennewell, 2005; Wood & Ashfield, 2008). These data indicated the affordances of IWB technology such as interactivity, speed, capacity and range, enhanced the delivery and pace of learning sessions. Kennewell described one teacher's use of the IWB as "not purely linear." Specifically, the teacher navigated through multiple documents, PowerPoint slides and used flip chart software to maintain the pace of the lesson. In contrast, studies have indicated little to no evidence of enhanced student learning in association with interactive whiteboards (Armstrong et al., 2005; Higgins et al., 2007). These researchers found no significant differences in the test score of an IWB school and schools without the technology.

Haldane (2007) observed teachers using IWB technology to modify displayed content by annotation, skipping back to previous screens or visiting a

relevant Internet site known to them. During teacher-led lessons, the board was used mainly as a presentation device. Smaller fragments of knowledge were displayed on the board to serve as focal points for the teacher's elaboration and explanation. Beauchamp and Parkinson (2007) suggested a strategy to assist pupils in forming links between familiar and new forms of presentation using the IWB. In this case, it was noted that similar media could be used to achieve similar results, however the use of the IWB allowed the teacher to annotate, cut out certain scenes, focus in on other features and generally adapt the screen to fit the learning needs of the class with a single medium. The degree of interactivity, which the IWB actually affords within the classroom, is dependent upon the use to which they are put (Kennewell, 2004).

Many IWBs were still being used in traditional formats, limiting the level of interaction between pupils and the equipment (Beauchamp & Kennewell, 2009; Kitson et al., 2007). In these cases, the IWB was used as a presentation medium, displaying the contents of the lesson while the teacher lectured to the class. When IWB technology is used solely as a presentation tool, interaction is limited (Armstrong et al., 2005). This under uses the potential of IWB affordances and decreases the potential benefits of technology funding.

Technology can be used to motivate students by engaging them with the lesson (Beeland, 2002). Researchers (Hennessy, Deaney, et al., 2007; Hennesy, Wishart, et al., 2007) indicated that teachers unanimously agreed that active physical manipulation of objects by pupils on the IWB was beneficial in terms of learning and motivation. In a study conducted by Torff and Tirotta (2009),

teachers who strongly supported using the IWB increased student motivation by allowing them to manipulate items on the board. Offering students a degree of control over their own learning can provide challenge, motivation and engagement for a wide range of student groups, (Hennessey, Deaney, et al., 2007). Moss et al. (2007) indicated that using the IWB to promote oral and physical participation among the pupils and interactive whiteboard, maintained student activity throughout the lesson.

Barriers to IWB Use

For technology to truly be integrated into classrooms, it may be necessary to first integrate it into the curriculum. In 2004, Hokanson and Hooper noted that, "We envision a curriculum where technology use is determined by its capability to support learning. In such an environment, computers would be used as an active part of the classroom, where technology is not a special event, but rather a normal part of the classroom and curriculum" (p. 3). The reality of this vision is rarely experienced because teachers face barriers to technology integration. Common barriers to technology integration include: Professional development, teacher attitudes, and beliefs. Technology training often focuses on the basic operation rather than curriculum integration (Franklin, Turner, Kariki, & Duran, 2001). This may be a result of initial training being conducted by product vendors as opposed to instructional designers or technology coaches. Cuban, Kirkpatrick, and Peck (2001) indicated that although many district and on-site sessions focus on general computer skills, the generic training was irrelevant to teachers' specific needs. Ertmer (1999) suggested that teachers need ongoing

opportunities to use technology in ways that model the type of learning experiences they are asked to create. Hew and Brush (2007) suggested that technology integration was directly influenced by the teacher's attitudes and beliefs toward using technology. They argued that teachers who viewed technology as merely "a way to keep kids busy," did not see the relevance of technology for the designated curriculum. Grant, Ross, Wang, Potter, and Wilson (2004) completed an evaluation study of the "Learning Without Limits" program. The Learning Without Limits program was a pilot project designed to determine the impact of changing the ways students learn and teachers instruct in a technology-rich environment. The researchers concluded that technology implementation was determined by the educational philosophies and pedagogy of the classroom teacher. Hokanson and Hooper (2004) suggested the range of computer technology integration was broad and included different levels of involvement and use, which were tied to a curriculum and the instructor's ability to accept and use new technologies.

One barrier to IWB use is that many teachers are not familiar with the technology to use it to its best advantage. There has been criticism that in too many classrooms, interactive whiteboards are nothing more than fancy, expensive chalkboards. This occurs most often when teachers who do not know how or refuse to use IWB technology ignore interactive features (Manzo, 2010). Another barrier may be inherent with the initial use and attraction of interactive whiteboard use. IWB technology is often praised for its ability to engage students and capture their attention, however some researchers suggest that this

characteristic enslaves students, leaving them less able to operate manage, channel, conserve, and control their own attention (de Castell & Jenson, 2004). The researchers also suggested the use interactive whiteboards may increase student dependency on the device to retain and exercise sovereignty.

Teacher Concerns Toward Technology Use

Hall, George, and Rutherford (1977) defined concerns as the composite representation of the feelings, preoccupation, thought and consideration given to a particular issue or task. Hall continued by suggesting, to be concerned meant to be in a mentally aroused state about something. In terms of interactive whiteboards and the implementation of the innovation, it is often assumed that teachers have a high level of mental arousal and positive attitudes and perceptions toward the technology. However, it is important to acknowledge that learning brings change, and supporting people in change is critical for learning to take place (Loucks-Horsely, 1996).

Concerns Based Adoption Model (CBAM)

The Concerns Based Adoption Model (CBAM) was developed based on the research of Frances Fuller (1969). Frances Fuller conducted a series of studies of teacher's concerns. Fuller proposed a developmental conceptualization of teacher concerns. She believed that teacher concerns occurred in a nature sequence and were not a consequence of the quality of a particular teacher education program.

The CBAM was developed at the Research and Development Center for Teacher Education (R & CTE) at the University of Texas at Austin. Researchers

(Hall, Wallace, & Dossett, 1973) began an investigation based on individuals who were asked to change their practices or adopt an innovation. These researchers believed that the process of change or adoption of an innovation began with the teacher. Therefore, their focus was to understand what happens to teachers when presented with a change. The researchers observed that teachers involved in adopting an innovation appeared to express concerns similar to those Fuller had identified. The teacher concerns were documented and categorized. The researchers also recognized a logical progression as users became increasingly confident in using innovations. As a result, seven Stages of Concern (SoC) about an innovation through which individuals progressed as they implemented an innovation and became competent in using it were identified. Active research on CBAM tools continues, as well as the use of the CBAM framework and tools, along with learning from their applications.

CBAM is a conceptual framework that describes, explains and predicts probable teacher concerns and behaviors throughout the school change process. CBAM is one model used to evaluate the change in individuals. The development of this model was initiated as an attempt to identify the barriers that prevented the successful implementation of change innovations. Before CBAM development, best practices were presented in terms of discrete innovations or programs, developed by external sources and presented to teachers and schools as a packaged product. Theoretically, teachers only had to adopt the innovation to achieve the desired results promoted by the external sources. The promoted

results from the original site of development were rarely replicated to the new campuses.

The CBAM model is client-centered; therefore, it can identify the needs of individuals during the change process. This approach can maximize the prospects for successful school improvement projects while minimizing the innovation-related frustrations of individuals. A central and major premise of the CBAM is that the single most important factor in any change process is the people who will be most affected by the change. This framework is designed to help change facilitators identify the needs of individuals during the change process and address those needs based on the data gathered through the models diagnostic dimensions.

Loucks-Horsely and Matsumoto (1999) indicated the following CBAM Assumption and Assertions based on the implementation of innovations in college and school setting:

- Change is a process, not an event, and it takes time to institute change;
- Individuals must be the focus if change is to be facilitated and institutions will not change until their members change;
- The change process is an extremely personal experience and how it is perceived by the individual will strongly influence the outcome;
- Individuals progress through various stages regarding their emotions and capabilities relating to the innovation;

- The availability of a client-centered diagnostic/prescriptive model can enhance the individual's facilitation during staff development; and
- People responsible for the change process must work in an adaptive and systematic way where progress needs constant monitoring.

The CBAM addressed each one of these assumption by providing three diagnostic tools- Stages of Concern (SoC), Levels of Use (LoU), and Innovation Configuration (IC). The research for this study was conducted using the theoretical frame work of the CBAM. Specifically, this study utilized the Stages of Concern dimension of CBAM and the Stages of Concern Questionnaire (SoQC) to measure the seven Stages of Concern about the innovation.

Stages of Concern Questionnaire (SoCQ)

Concerns are an important dimension in working with individuals involved in a change process (George, Hall, &Stiegelbauer, 2006). Although one can experience many types of concerns about an innovation concurrently, an individual will perceive certain aspects of the innovation as more important than others at a given time. The Stages of Concern dimension of the CBAM focuses on the concerns of individuals involved in change (Hall, 1979). CBAM identifies and provides ways to assess seven stages of concern about the innovation, which are summarized in Table 1. The Stages of Concern Questionnaire is the primary tool for determining where an individual is in the stages.

In 1973 research attempts were made to assess the concerns of individuals about a specific innovation. Developers explored the use open ended formats, Likert scales, adjective checklist, and interviewing procedures to measure the

concerns. In 1974, developers established a quick-scoring pencil and paper questionnaire to measure the Stages of Concern About an Innovation. Since the publication of the original Stages of Concern Questionnaire (SoCQ) manual in 1978, the questionnaire has been used in an extensive array of studies. During the 1980s, four major research studies modified the SoCQ to measure concerns about innovations in nonteaching applications and replicated the development process (Hall, Newlove, George, Rutherford, & Hord, 1991):

- Kolb (1993) adapted the SoCQ to assess nurse's concerns about the nursing field.
- Barucky (1984) adapted the SoCQ to measure concerns about leadership development in United States Air Force officers.
- Jordan-Marsh (1985) adapted the SoQC to measure concerns about exercise.

Martin (1989) adapted a concerns questionnaire for individuals learning computer programming.

The present format of the SoCQ has four parts: the cover letter; the introductory page; two pages of statements, or items, for the respondents to evaluate; and the demographic page. All four components can be administered and results can be collected through the Internet. Holistic interpretations of the results are based on the conversion of item raw score totals for each scale into percentile scores that become the basis for constructing SoCQ profiles.

Table 1

Stages of Concern about an Innovation

Stage of Concern	Expression of Concern
6. Refocusing	The individual focuses on exploring ways to reap more universal from the innovation, including the possibility of making major changes to it or replacing it with a more powerful alternative.
5. Collaboration	The individual focuses on coordinating and cooperating with others regarding use of the innovation.
4. Consequence	The individual focuses on the innovation's impact on students in his or her immediate sphere of influence. Considerations include the relevance of the innovation for students; the evaluation of student outcomes, including performance and competencies; and the changes needed to improve student outcomes.
3. Management	The individual focuses on the process and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organization, managing, and scheduling dominate.
2. Personal	The individual is uncertain about the demands of the innovation, his or her adequacy to meet those demands, and/or his or her role with the innovation. The individual is analyzing his or her relationship to the reward structure of the organization, determining his or her part in decision making, and considering potential conflicts with existing structures or personal components. Concerns also might involve the financial or status implications of the program for the individual and his or her colleagues.
1. Informational	The individual indicates a general awareness of the innovation and interest in learning more details about it. The individual does not seem to be worried about him or herself in relation to the innovation. Any interest is in impersonal, substantive aspects of the innovation, such as its general characteristics, effects, and requirements for use.
0. Unconcerned	The individual indicates little concern about or involvement with the innovation.

Source: *George, Hall and Stiegelbauer, 2006.*

Attitudes and Perception Toward Technology Use

Ertmer (2005) suggested that researchers must examine teachers themselves and the beliefs they hold about teaching and technology if educators are to achieve fundamental or secondary changes in classroom teaching practices. Williams, Coles, Wilson, Richardson, and Tuson (2000) found that teachers generally possess an overall positive attitude toward technology integration. Although arousal levels may be high, there is not enough research to support the assumption that it is frequently positive. Research has focused on the attitudes and perceptions of students (Hall & Higgins, 2005; Kennewell & Morgan, 2003); however, it is necessary to focus on the attitudes and perceptions of those who predominantly control the methods and strategies to be used with interactive whiteboards.

Interactive whiteboard technology combines interactive elements and resources that can assist with decreasing many of the perceived barriers with the use of technology. However, teacher beliefs concerning their personal ability to effectively use technology and their beliefs regarding the potential effect on student achievement is quite possibly the most significant factor in determining what actually happens in the classroom (Levin & Wadmany, 2006; Rakes et al., 2006; Zevenbergen & Lerman, 2007). Personal belief systems have a powerful effect on what teachers learn from educational reform schemes and professional development programs. Levin and Wadmany suggested these systems also affect the teachers' curricular decision-making and teaching practices. Strehle, Whatley, Kurz, and Hausfather (2002) concluded that teachers' attitudes toward

the use of technology positively shifted after receiving training; however, they still questioned what technology to use and when to use it. Cox et al. (2004) suggested the majority of teachers require a high level of knowledge and confidence with tools such as interactive whiteboards to assist pupils in the learning process. Hooper and Rieber (1995) described five stages of teachers' use of technology: (a) familiarization, (b) utilization, (c) integration, (d) reorientation, and (e) evolution. The assertion was made that teachers did not pass the second stage of technology use. During this stage, the researchers suggested that teachers find satisfaction in their level of technical knowledge; however, they lack the commitment to fully use the resources. This premature sense of accomplishment and lack of commitment leads to abandonment of technology resources at the first sign of technical failure.

The questions of when and what technology to use are associated with the integration stage of the use of technology; however, this stage is rarely achieved. Prior to the integration stage, researchers identified the utilization stage. Hooper and Reiber (1995), define the utilization stage as the time when teachers try out technology or innovation in the classroom as opposed to the integration stage in which teachers consciously decide to designate certain tasks and responsibilities to the technology. Therefore, teachers may be satisfied with their personal level of knowledge about a technology while experiencing anxiety when attempting to initially use the tool in the classroom, hindering the proper application of the technology for teaching and learning. It is important that teachers understand that technology does enable constructivism. The teacher

must understand when to use the tools to assist students in gaining a deeper understanding (Judson, 2006).

The effects of IWB technology on teachers should be considered to be equally important to the effects of IWB technology on students. The effects of IWB technology on teachers could be more influential toward long-term implementation, as teachers are the key to most IWB use in the classroom (Loucks-Horsely & Matsumoto, 1999). Research indicates that a greater positive perception of computer importance among the students in a classroom also fosters higher computer anxiety in their teachers (Christensen, 2002). An early study by Bell (2002) examined teacher perceptions of the value of IWB use. During this study, an Internet survey was used to poll IWB user perceptions on a number of issues, particularly on teaching effectiveness, effect on learning, and importance of interactive learning. Thirty teachers from a variety of backgrounds and subject areas responded during the eight day response time. The survey utilized both Likert Scale questions and open-ended questions. Bell concluded from her analysis of the responses that there was an overall positive attitude to IWB use. Ninety-three percent of respondents rated the interactivity of the IWB as important, very important, or extremely important. The interactive and collaborative nature of IWB use was found to be among its most valuable attributes supporting its effectiveness as a tool for fostering interactive learning.

Ongoing professional development may serve to decrease the anxiety level of teachers in relation to technology integration. Ertmer (1999) concluded

that although teachers recognize the importance of integrating technology into their curricula, both external and internal barriers often limit efforts.

Summary

Interactive whiteboard technology has been introduced in the K-12 environments with the promise of increased student achievement. However, the current body of research has only produced mixed results to support this claim. Contrary to some beliefs, the interactive whiteboard may not have an impact on instruction as a standalone device. The ways in which teachers use the technology in the classroom may influence the impact these tools have on student attainment. Variables that assist teachers in the facilitation of the device should be taken into consideration and further explored. The instructional practices of teachers and the pedagogy that influences these practices need to be identified in order to establish solid models for the effective use of interactive whiteboard technology. Moreover, the specific strategies used to engage students in interactive activities should be analyzed to determine the impact on student motivation, attainment and achievement. In addition to the ways and extent to which teachers use interactive whiteboards in the classroom, teacher attitudes and perceptions toward the use of the technology will be analyzed.

Chapter 3

Methodology

The purpose of this chapter is to document the research questions, design, data analysis, setting, population sample, instruments, collection methods, participant considerations, and current research data, which were used to investigate the questions of this study. Philosophical assumptions were acknowledged in an attempt to bracket the researcher's beliefs and narrow the focus on the assumptions implicated by the participants.

Purpose Statement

The purpose of this study was to investigate the perceptions and attitudes of a select group of teachers toward the implementation of interactive whiteboards. Strategies teachers used with the technology and the associated uses of IWB affordances were also investigated.

Research Approach and Design

Research Questions

The following research questions guided the study:

1. What instructional strategies were observed in a sample of classrooms equipped with IWB technology and how they compared to CREP norms?
2. How were the Interactive whiteboards observed being used in the sample classrooms implementing IWB technology?
3. What levels of concern, attitudes, and perceptions did teachers indicate toward IWB implementation and use in the sample classrooms?

Assumptions

Although teachers participate in similar training and professional development, learning experiences and actual application of acquired knowledge and skills will differ. An attempt to minimize the conceptual distance between the researcher and participants was made to explore the evidence of the different perspectives. This study was guided under the assumption that research is value laden. The researcher attempted to bracket out personal values and beliefs derived from the experience of the phenomena.

Data analysis can be subjective. Biases may have been present because of the researcher's experience with professional development and training. In quantitative research, the researcher neither participates in nor influences what is being studied. However, the researcher conducting this study had been a major participant in past training efforts. The researcher has three years of experience in K12 teacher training. During that period it was observed that teachers, undergoing similar training sessions, perceived the content differently, resulting in varying uses of the content and skills. Therefore, as observations were being made during this study, the researcher strictly used observation forms formulated by valid research institutions. This study was written in a descriptive scientific format using data analysis from observations and survey data provided by the research participants.

This study is underlain by several assumptions. Survey respondents were novices in the use the interactive whiteboards for instructional purposes; teachers used technology more often for administrative tasks as opposed to

instructional practices. Interactive whiteboards were primarily used as a presentation tool. The survey questions were valid and would be understood by respondents. Finally, the data yielded from the study would be beneficial to the school and those educators in Tennessee who were looking to implement interactive whiteboards in classrooms.

This was the first year that interactive whiteboards were installed on this campus; therefore, exposure to the technology may have been limited to that received during teacher preparation programs or there may have been no prior exposure at all. A 2000 report from the National Center for Education Statistics concluded that many teachers used computers to conduct preparatory and administrative tasks and generally used technology less frequently for such tasks as accessing research, best practices examples, and model lesson plans, as well as communicating with parents and students (U.S. Department of Education, 2000).

Delimitations of the Study

The following delimitations underlie the study:

- The population: urban school district located in the mid-south
- The sample taken for observation was taken from teachers with working experience and knowledge of interactive whiteboard technology tools.

The population for this study only represented a small percentage of the teachers in the school district and an even smaller percentage of teachers located within the mid-south. This particular campus was identified as an exemplary campus and was the recipient of several grants enabling the purchase

and installation of multiple interactive whiteboards. The teachers in this sample were all first year recipients of interactive whiteboards. Installation of the boards were partially accomplished during the school year, therefore, much of the teachers' experience was acquired through work-related practice and real life experiences. This training may be limited in comparison with teachers who have the opportunity to use the technology immediately after undergoing professional development.

Limitations of Study

The primary limitation of this study was no generalizations could be made toward the general population based on the small sample size of participants. Participants in this study were selected based on whether or not an interactive whiteboard was installed in their classroom. As a requirement for receiving grant funds, teachers were required to participate in research-related efforts. Therefore, honesty in the use of interactive whiteboards and in responses to survey questionnaires was a concern.

The following limitations underlie the study:

- Participation in this study was mandated by the school district; therefore, teacher motivation to participate in the study may not be intrinsic.
- The study only pertains to one school district; therefore, it would not be generalized across other K-12 school districts.

Design

This study focused on the implementation of interactive whiteboards on a unique K-8 campus. Therefore, a single case study design was selected. A case study research methodology relies on multiple resources for data collection. These data provide depth of the analysis as data is triangulated to add richness to the study (Yin, 2003). Case study is an ideal methodology when a holistic, in-depth investigation is needed (Feagin, Orum, & Sjoberg, 1991). The observation of teachers and their associated strategies was a key component in this study. Yin (2003) suggested the case study was preferred in examining contemporary events, when the relevant behaviors could not be manipulated.

The design of this study focused on the observation of teaching strategies incorporated in K-8 classrooms equipped with interactive whiteboards and teacher levels of concern towards innovation. For the context of this study, "strategies" was defined as the approach a teacher would take to achieve learning objectives, and "activities" was defined as teaching and teaching-related activities such as curriculum development to include preparing for and conducting class instruction, developing instructional materials and using instructional resources. Survey data were used to record variables that influence teaching strategies. Norm data was used to provide a baseline for comparison of the frequency of teaching strategy use.

The researcher's methodology focused on quantitative methods. Quantitative data were collected during fall 2010 through classroom observations, from structured online and paper-based data collection

instruments. These data collection procedures were chosen to decrease the economical impact on the researcher and to collect unobservable data while permitting the collection of observable data. Data collection methods were guided by the research questions.

Setting

This school was chosen based on the recent acquisition of interactive whiteboards. The school district received $18,430 in matching funds from a local education foundation to equip nineteen classrooms with IWB technology. The research setting for this study was a K-8 school located in the mid-south. This school represented three classifications of learning sites: primary, intermediate and middle schools representing grades K-8. Participating classrooms were equipped with an interactive whiteboard system consisting of a digital board, computer, digital projector, and a wireless peripheral device. Financial support for the purchase of interactive whiteboards was secured through a state funded grant.

Population and Sample

The population for this study was 54 certified teachers from the public school described above in the “Setting” section. The population consisted of 20 grade K-2, 17 grade 3-5, and 17 grade 6-8 teachers. Teachers in this population ranged in age from 24-60 years. Teaching experience ranged from 1-30 years. The 19 teachers included in the sample were all female. This was not by design.

The first 19 installations of IWB systems were divided into phases. Phase 1 consisted of 16 installations. Three more systems were installed during the fall

school year. A training session hosted by the corporate sponsor was conducted before the first phase of IWB installations. All 19 teachers from the sample participated in this session. During this session, an initial introduction to the hardware and available software package was demonstrated rather than an instructional session on how to integrate the package with existing lessons. The presenter exhibited hardware and software functionality, including touch screen capabilities, audio and video recording and playback, and various pre-developed media-rich lessons.

Instruments

Four instruments were used for this study; two for classroom observations and two teacher surveys. The observation instruments were the School Observation Measure (SOM; Ross, Smith, Alberg, 1999), developed by the University of Memphis-affiliated Center for Research in Educational Policy (CREP) and the IWB Teacher Activity Observation tool, a researcher developed observation tool. Teacher surveys were the Stages of Concerns Questionnaire (SoCQ; George et al., 2006) developed by Southwest Educational Development Laboratory (SEDL) and the Teacher Evaluation Survey that was developed and distributed by the campus principal. The SOM was used to collect data regarding overall classroom activities. The IWB Teacher Activity Observation tool was used to indicate what qualities of the IWB were used during classroom instruction. The SoCQ was used to collect data regarding teacher concerns about integrating interactive whiteboard technology into their current teaching practices, whereas the Teacher Evaluation Survey evaluation survey was used to gather self-

assessment data on teachers' IWB use. The researcher chose these instruments because they provided a means to collect the data necessary to answer the research questions. These instruments were also economical, could be completed in a short time frame, and could be easily distributed.

Classroom Observation Instruments

School Observation Measure. The School Observation Measure was originally developed by the Center for Research in Educational Policy (CREP) at the University of Memphis. The SOM was developed to determine the extent to which different common and alternative teaching practices are used throughout an entire school or program (Ross et al., 1999). Classroom Observation Notes for the SOM were designed to capture 15 minutes of classroom observation data. Classroom Observation Note forms are used to record the name of the school, grade level of the observed class, observer's name, the actual time of observer entry and exit from the classroom, the observation date and SOM number, subject activity overview, and an indication of whether the observation is targeted or not targeted. The SOM measures the frequency of occurrences of 24 targeted practices and two summary items. The 24 instructional practices are grouped into six categories: instructional orientation, classroom organization, instructional strategies, student activities, technology use, and assessment. In addition to the six categories, two summary items are used to measure the level of academically focused class time and student attention/interest and focus. Instructional practices are rated as not observed, rarely, occasionally, frequently, or extensively observed. The two summary items are rated on a scale of 1 (low) to 3

(high). This instrument measures the frequency of these practices at the multi-class level. A sample of the SOM Data Summary form and Classroom Observation Notes for the School Observation Measure are located in Appendix D.

To ensure the reliability of data, the researcher received a manual that provided definitions of SOM terms, examples and explanations of observation strategies. Multi-class observations were used to capture routine classroom practices that typically occur on a regular basis with the 19 participating teachers. One school observation consisted of 3 hours of observation, conducted in 15-minute observations in approximately 10 randomly selected classrooms. In addition to information provided by CREP, the Classroom Observation Notes for School Observation Measure and SOM Data Summary Forms for all observations underwent a research crosscheck by the Senior Associate Director of CREP.

IWB Teacher Activity Observation Tool. The IWB Teacher Activity Observation Tool, a researcher-developed tool, was used to record the observed use of interactive whiteboard affordances. This tool comprised 21 items grouped into 11 categories: annotation, object manipulation, screen capture, presentation device, Internet access, self-developed lesson, preloaded activities, audio, animation, stimulation, and hyperlinks. The instrument measured the frequency of the observed functions with a 0-4 Likert response scale ranging from not Observed to Extensively Observed. These items were based on observable functions of interactive whiteboards gathered from SMART Technologies Inc

(SMART Technologies Inc., 2006). These affordances were also based on research that identifies the tools and software commonly used for classroom instruction (Kennewell & Beauchamp, 2007; Painter, Whiting, & Wolters, 2005). At the end of each classroom observation, the researcher indicated the frequency of each observed function. A copy of the IWB Teacher Activity Observation Tool is located in Appendix G.

Teacher Surveys

Stages of Concern Questionnaire. The Stages of Concerns about an Innovation was developed as one of three diagnostic dimensions of the Concerns-Based Adoption Model (CBAM), a framework for measuring implementation and for facilitating change in schools (George et al., 2006). The Stages of Concerns Questionnaire (SoCQ) provides a way for researchers, program evaluators, administrators, and change facilitators to assess teacher concerns about educational "innovations" or strategies, programs, or materials introduced in schools (George et al., 2006). The SoCQ provides a quick measure of seven stages of concern about the identified innovation: stages 0 to 6. Each stage is comprised of five associated statements. The 35 statements are intended to solicit participant attitudes or beliefs about the "innovation." Respondents mark each item on a 0-7 Likert scale according to how true the item seems to them at the present time. High numbers indicated high concern; low numbers, low concern; and 0 indicated very low concern or completely irrelevant items. The SoCQ was customized for this study by replacing the term "innovation" with "Interactive Whiteboard" or "IWB." In addition to the 35-item

questionnaire, this instrument included a demographic page. This page was used to gather participant information for sample description. Completion of the SoCQ should take approximately 10-15 minutes. A sample of the SoCQ is located in the Appendix F.

Teacher Evaluation Survey. The Teacher Evaluation Survey, a self-assessment survey distributed by the campus administrators was used. This survey was designed for teachers to evaluate their use of interactive whiteboards at two levels, completion of goals and objectives, outcomes and results of the implementation of interactive whiteboards on the campus. The survey was comprised of 14 open-ended questions. Participating teachers responded to each question. The survey was completed by participating teachers and collected by school administrators. A copy of the Teacher Evaluation Survey is located in Appendix H.

Procedures

A sample size of 19 teachers was selected based on their access to an IWB from beginning of the school year. These teachers were randomly observed. Although the teachers were selected and aware of their observation, teachers did not know when the observations would occur. The researcher randomly scheduled observation dates and times in an effort to increase the validity of the data.

Two measurement strategies were used to collect the evaluation data: direct classroom observations and surveys. The researcher collected observation and survey data from the research campus in the fall of 2009 and spring of 2010.

Survey data was physically collected from teachers at the research campus and over the Web. Following are descriptions of the procedures used with each evaluation instrument.

Classroom Observations

School Observation Measure (SOM). The senior associate director of CREP trained the researcher as an observer to conduct classroom visits to collect frequency data regarding observed instructional practices. The observation dates were scheduled in advance with the campus principal. During each visit, teachers were randomly selected from those who participated in the school's IWB technology training and implementation in their classrooms. Selected teachers were not made aware of the date or time of their observations.

An invitation to participate in a study of the implementation of interactive whiteboard (IWB) technology was distributed to the nineteen teachers with IWB systems in their classrooms. Teachers of the following subject areas received the invitation: (a) Math, (b) Science, and (c) Language Arts. The invitation letter also served as a consent form for teachers to be voluntarily observed during normal school hours. Teachers were to sign the letter and return it to their principal. The observations were conducted in accordance with the University of Memphis Center for Research in Educational Policy's School Observation Measure. A total of 19 teachers were observed over a 6 week period. Observations were conducted 1-2 days a week. During each observation day, a minimum of 10 classrooms was observed for 15-minute periods. Individual observation forms were used to collect data from each 15-minute period. At the end of each

observation session, a summary form was used to summarize the total observations from that day. The number of SOM observations was approximately the same for the research campus and control schools, 6 and 7, respectively.

The researcher selected 10-12 classrooms to observe per visit. The sequence of individual observations was conducted in a random manner. A diverse combination of grades and classrooms were observed during subsequent visits. Observations were conducted over a total of 6 days. The researcher cycled through all of the classrooms under study, observing each teacher a minimum of three times. Classroom observations were limited to the following core subject areas: language arts, mathematics, science, and history. The researcher attempted to be unobtrusive; however, during student-centered activities, the researcher moved around to observe in greater detail.

The SOM was used to capture routine classroom practices that typically occurred on a regular basis with the 19 participating teachers. Classroom events and activities were recorded descriptively, but rather judgmentally. Classroom Observation Notes for School Observation Measure forms were completed during each 15-minute observation. The observer recorded the use or non-use of the 24 target strategies and the levels of academically focused class time and student attention/interest. At the conclusion of the 3 hour school observation, the observer used an SOM Data Summary Form to summarize the frequency with which the 24 target strategies were observed and the levels of academically focused class time and student attention/interest. A 5-point rubric, ranging from (0) Not Observed to (4) Extensively, was used to record the frequencies.

*IWB Teacher Activity Observation Tool***.** The IWB Teacher Activity Observation Tool was used to capture the observed use of interactive whiteboard affordances. During each 15-minute observation, the researcher indicated the observed use of an IWB function by placing a mark next to the listed affordance. At the end of the 3 hour school observation, the markings were tallied and summarized. The computed scores were recorded using the following scale: 0 markings = Not Observed, 1 marking = Rarely Observed, 2 markings = Moderately Observed, 3 or more markings = Frequently Observed.

Teacher Surveys

Stages of Concern Questionnaire (SoCQ). Data for the SoCQ were gathered using online collection methods. Teachers received an email message through their campus email system containing a link to the Online SoCQ and a cohort password. The password-protected option was chosen to increase validity in this study. All respondents were to complete the same survey. Four subgroups were created to further diversify the analysis options available to the researcher by gathering the following information: years with IWB access in their classroom, primary grade taught, years of teaching experience and subject area. Survey completion was to take approximately 5-10 minutes. This data was electronically submitted to the researcher for analysis. An email containing a link to the Web-based online questionnaire was originally sent to the campus principal. After his review and approval, the questionnaire was forwarded to all participating teachers with an interactive whiteboard. The introductory page of the survey invited teachers to participate in a questionnaire related to interactive

whiteboards. The page also provided the purpose of the survey and the approximate time of completion. Instructions for completing the survey were displayed with sample explanations demonstrating the 7-point scale used in the survey. The survey administrator received an email confirmation when a user completed the survey. Participants were given two weeks to complete the survey.

Teacher Evaluation Survey. Data for the Teacher Evaluation Survey were also collected using online collection methods. Teachers received an email message through their campus email system containing the 14 open-ended questions. All respondents completed the same survey by answering the questions and sending their response digitally via the email, or printing the questions and manually returning the survey to administrators. Survey completion was estimated at approximately 15-20 minutes. A printed copy of each completed survey was provided to the researcher.

Data Analysis

Data collected through the School Observation Measure and the IWB Teacher Activity Observation Tool was used to answer research questions 1 and 2. Data were tabulated and converted into the following descriptive statistics: frequencies and percentages for each level of response as well as means and standard deviations. SOM data from this study and CREP Norm data were used for a comparative analysis. Descriptions gathered through the Teacher Evaluation Survey were used to answer question 3. Responses to the open-ended questions were analyzed for the deduction of themes (Creswell, 2007). Common themes to support the research questions were described. Select

illustrative quotes were used to exemplify particular themes. To answer question 3, teacher concerns were analyzed using a profile analysis. This was the most frequently used method of interpreting data from the SoCQ and provides researchers with the highest level of analytical data (George et al., 2006). Data from the SoCQ were converted to tabular listings of percentile scores. These scores were plotted and graphed to create a complete clinical interpretation and assessment of both individual and whole cohort data in the form of a profile. The respondents' affective stance toward the IWB and types of concerns that were most and least intense were gathered from the profile data. In other words, the teachers' emotional perceptions of IWB implementation were derived from the profile analysis. Additionally, profile data provided direction and evidence for the design of interventions to help move participants to the next developmental stage of IWB implementation (George et al., 2006). Table 2 provides an overview of the research questions, the associated data collection instrument and statistical analysis used to examine the data.

Participation Consent and Confidentiality

All data collected through the observations and interviews was confidential in accordance with the Human Subject principles outlined by the University of Memphis Institutional Review Board. A copy of the consent form is located in Appendix I. Participation in this study was a requirement of the grant funding; however, participation in the observations was voluntary and confidential. To avoid deception, the purpose and intent for the study were clearly communicated in the initial notification provided to the sample. Confidentiality was maintained

within the quantitative aspect of this study, as no personal information was requested from the participants or recorded during the observation.

Table 2

Research Question Matrix

Research Question	Collection Instrument	Analysis
What instructional strategies were observed in a sample of classrooms equipped with IWB technology and how they compared to CREP norms?	School Observation Measure (SOM) IWB Teacher Activity Observation tool	Descriptive Statistics (Frequencies, Percentages, Standard Deviations, t-Test)
How were the Interactive whiteboards observed being used in the sample classrooms implementing IWB technology?	School Observation Measure (SOM) IWB Teacher Activity Observation tool	Descriptive Statistics (Frequencies, Percentages, Standard Deviations, t-Test)
What levels of concern, attitudes, and perceptions did teachers indicate toward IWB implementation and use in the sample classrooms?	Stages of Concern Questionnaire (SoCQ)	SoCQ Profile analysis

Chapter 4

Results

This chapter presents the findings for this study by research question. The study investigated the ways and the extent that teachers used IWB technology in the classroom. The study was quantitative in design. Demographic data included the primary grade taught, years of teaching experience, and instructional subject area. Descriptive statistics expressed as frequencies and percentile scores were computed for all items; means, and standard deviations were computed for all relevant item scales. The study also investigated the levels of concern toward IWB use in the classrooms, which existed among Tennessee teachers, and how these concerns affected the level of IWB use. The teachers who participated in the study were certified, teaching in a public school, with an interactive whiteboard installed in the classroom. This chapter presents data relevant to the use of IWB technology in the classroom and teachers' perceptions.

Teacher Demographics

Demographics for the 19 teacher participants (Table 3) reflected a varied range of grades, subject areas taught and years of teaching experience. The fifth grade was selected as the target year because of the daily classroom rotation system implemented at that grade level. Consequently, the fifth grade represented 26% of the grade levels in this sample. The second grade was the next highest represented grade in the sample at 16%. First, third, sixth, and seventh grades each represented 11% of the total sample, while kindergarten, fourth, and eighth grades each represented 5% of the total sample.

Subject areas were categorized into three core areas. Language arts totaled 63% of the teachers in this sample as all K-5 teachers teach language arts. Science equaled 21%, while math classes made up 16% of the total sample.

By percentages, the demographic data indicated that 53% of teachers in the sample ranged had 11-20 years of teaching experience. Teachers with 21-30 years were the second highest percentage in the sample with 21%. Teachers with 5-10 years of teaching experience were the third highest group with 16%, while teachers with 1-2 or 3-4 years of experience, each represented 5% of the total sample.

Question 1: What instructional strategies were observed in a sample of classrooms equipped with IWB technology and how they compared to CREP norms?

School Observation Measure. As shown in Table 4, data from multi-class observations revealed that the teachers did implement student–centered activities during the observations. Specifically, the following strategies were observed frequently or extensively during the indicated percentage of visits: Direct instruction (100%), Teacher acting as coach/facilitator (100%), Computer for instructional delivery (83%), Technology as a learning tool or resource (83%), High level of academically focused class time (83%), and High level of student attention/ interest/ engagement (83%). The following uses were of key interest to

Table 3

Demographic Characteristics of Participants (N=19)

Characteristic	*n*	%
Grade level taught		
K	1	5
1	2	11
2	3	16
3	2	11
4	1	5
5	5	26
6	2	11
7	2	11
8	1	5
Subject area taught		
Language Arts	12	63
Math	3	16
Science	4	21
Year of teaching experience		
1-2	1	5
3-4	1	5
5-10	3	16
11-20	10	53
21-30	4	21

the study due to the interactive nature and qualities inherent with the Interactive White-Board. These findings indicate the level of IWB use observed in the classrooms. Although these strategies are not implicitly bound IWB use, the high observation of less interactive strategies signifies the low observation of the interactive features of the white boards. The students were frequently to extensively observed working independently at their seats during (67%) of the observations. Students participating in experiential learning, or Individual Tutoring, were also occasionally observed during (67%) of the observations, whereas the use of higher level feedback was occasionally observed during (50%) of the total classroom observations. Conversely, the following strategies were not observed or rarely observed during all (100%) of the classroom visits: Team Teaching, Cooperative/ Collaborative Learning, Ability Groups, Multi-age grouping, Work centers in use, Integration of subject areas, Project based learning, Performance assessment strategies, and Student Self-assessment (portfolios).

Presented in Table 5 are the means and standard deviations derived from the multi-class School Observation Measure (SOM) from this study, noted as the "research campus" and the CREP 2007-2008 norms data. The CREP Norms data represents multi-class SOM observations. Results from the CREP norms were used as comparative norm data in this study. To determine statistical significance of the observations conducted at the research campus, a series of one-sample *t*-tests were run on all SOM items and standardized effect sizes were subsequently computed.

Table 4

Observed Frequency of SOM Criteria Across 10 Classrooms/Six Occasions*

SOM Criteria	None/ Rarely %	Occasionally %	Frequently/ Extensively %
Instructional Orientation			
Direct Instruction	0	0	100
Team teaching	100	0	0
Cooperative Learning	100	0	0
Individual Tutoring	33	67	0
Classroom Organization			
Ability Groups	100	0	0
Multi-Age Grouping	100	0	0
Work Centers in use	100	0	0
Instructional Strategies			
Higher-Level Feedback	50	50	0
Integration of Subject Areas	100	0	0
Project-Based Learning	100	0	0
Higher-Level Questioning	17	83	0
Teacher As Coach/Facilitator	0	0	100
Parent/Comm involvement	83	0	17
Student Activities			
Independent Seatwork	0	33	67
Experiential Learning	33	0	67
Individualized Instruction	0	0	0
Sustained Writing	0	0	0
Sustained Reading	0	0	0
Independent Inquiry/Research	0	0	0
Student Discussion	0	0	0
Technology Use			
Instructional Delivery	0	17	83
Learning Tool	0	17	83
Assessment			
Performance Assessment	100	0	0
Student Self-Assessment	100	0	0
Overall Academic Focus	0	17	83
Overall Student Engagement	17	67	17

Note. 0 = None, 1 = Rarely, 2 = Occasionally, 3 = Frequently, 4 = Extensively. Observation *N* = 6

*Used with permission from the Center for Research in Educational Policy, The University of Memphis

As seen in Table 5, a series of one-sample test comparing the means from this study and the CREP norms on the multi-class SOM items yielded a highly significant difference in seven items ($p < .05$, $p < .01$, or $p < .001$). Further analysis showed significantly higher frequency for the research campus on five items and significantly lower frequency on two items. Effect sizes ranged from -1.32 to +1.18, thus indicating relatively large effects. The seven items revealing the greatest difference were direct instruction (Research Campus $M = 3.33$, $SD = 0.52$, CREP Norm $M = 2.63$, $SD = 1.45$), teacher as coach/facilitator (Research Campus $M = 3.67$, $SD = 0.52$, CREP Norm $M = 2.45$, $SD = 1.57$), independent seatwork (Research Campus $M = 2.67$, $SD = 0.52$, CREP Norm $M = 1.37$, $SD = 1.47$), technology use for instructional delivery (Research Campus $M = 2.83$, $SD = 0.41$, CREP Norm $M = 1.60$, $SD = 1.70$), technology as a learning tool (Research Campus $M = 3.17$, $SD = 0.75$, CREP Norm $M = 1.18$, $SD = 1.62$), work centers in use (Research Campus $M = 0.33$, $SD = 0.52$, CREP Norm $M = 0.89$, $SD = 1.50$). In addition to the instructional strategies, overall student engagement (Research Campus $M = 2.17$, $SD = 0.98$, CREP Norm $M = 3.39$, $SD = 0.87$) appeared to be low.

Five additional instructional strategies were observed more often at the research campus vs. CREP norms, however, these strategies were not statistically significant at the $p > .05$, $p > .01$, or $p > .001$ levels (Table 5). These strategies were individual tutoring, higher-level feedback, higher-level questioning, parent/community involvement and experiential learning. Two additional instructional strategies were observed less often at the research

campus vs. CREP norms. These strategies were not statistically significant at the $p > .05$, $p > .01$, or $p > .001$ levels (Table 5). These strategies were project-based learning and overall academic focus.

Eleven strategies were not observed during the observation period (Table 5). Team teaching, cooperative learning, ability groups, multi-age grouping, individualized instruction, sustained writing, sustained reading, independent inquiry/research, student discussion, Performance Assessment, and Student Self-Assessment were not observed and therefore were not compared to the CREP norms.

Question 2: How were the Interactive whiteboards observed being used in the sample classrooms implementing IWB technology?

IWB Teacher Activity Observation Tool. Results from IWB observations indicated that some of the most basic features of the IWB were not used or rarely used during the observations (Table 6). Highly used IWB features, observed frequently or extensively were presentation device 34%, which teachers used to display presentation, notes or examples for group lectures and activities. The second most frequently observed use was pre-loaded activities 17%, such as interactive games or mathematical graphs were also observed. Key features not or rarely observed were highlighting 83% and text annotations 100%, teacher object manipulation 100%, screen capture 100%, sound effects 100%, streaming video 100%, animation 100%, and hyperlinks 100%.

Table 5

Comparison of Sample Means with CREP Norms on the School Observation Measure (SOM)*

SOM Criteria	Sample		Norm		*t*	*p*	*d*
	M	*SD*	*M*	*SD*			
Instructional Orientation							
Direct Instruction	3.33	0.52	2.63	1.45	3.30	0.021*	0.65
Team teaching	0.00	0.00	0.51	1.21			
Cooperative Learning	0.00	0.00	0.97	1.48			
Individual Tutoring	1.33	1.03	0.26	0.80	2.54	0.051	1.16
Classroom Organization							
Ability Groups	0.00	0.00	0.48	1.21			
Multi-Age Grouping	0.00	0.00	0.52	1.35			
Work Centers in use	0.33	0.52	0.89	1.50	-2.64	0.046*	-0.50
Instructional Strategies							
Higher-Level Feedback	1.50	0.55	1.15	1.40	1.56	0.179	0.33
Integration of Subject Areas	0.17	0.41	0.38	1.04	-1.25	0.265	-0.27
Project-Based Learning	0.50	0.55	0.62	1.36	-0.53	0.615	-0.12
Higher-Level Questioning	1.83	0.41	1.69	1.59	0.84	0.441	0.12
Teacher As Coach/Facilitator	3.67	0.52	2.45	1.57	5.75	0.002**	1.04
Parent/Comm involvement	0.67	1.63	0.09	0.56	0.87	0.423	0.47
Student Activities							
Independent Seatwork	2.67	0.52	1.37	1.47	6.12	0.001**	1.18
Experiential Learning	2.17	1.72	1.04	1.50	1.61	0.168	0.70
Individualized Instruction	0.00	0.00	0.09	0.59			
Sustained Writing	0.00	0.00	0.25	0.76			
Sustained Reading	0.00	0.00	0.26	0.80			
Independent Inquiry/Research	0.00	0.00	0.60	1.28			
Student Discussion	0.00	0.00	0.95	1.44			
Technology Use							
Instructional Delivery	2.83	0.41	1.60	1.70	7.35	0.000***	1.00
Learning Tool	3.17	0.75	1.18	1.62	6.50	0.001***	1.57
Assessment							
Performance Assessment	0.00	0.00	0.48	1.16			
Student Self-Assessment	0.00	0.00	0.19	0.82			
Overall Academic Focus	3.00	0.63	3.48	0.83	-1.86	0.121	-0.65
Overall Student Engagement	2.17	0.98	3.39	0.87	-3.04	0.019*	-1.32

Note. * p <.05. ** p <.01. *** p < .001.
Observation N = 6
*Used with permission from the Center for Research in Educational Policy, The University of Memphis.

Table 6

Summary of Classroom Observations of Interactive White-Board Usage

Activity	None/ Rarely %	Occasionally %	Frequently/ Extensively %
Annotation			
Highlighting	83	17	0
Text	100	0	0
Object Manipulation			
Teacher	100	0	0
Student	50	50	0
Screen Capture			
Teacher	100	0	0
Presentation Device			
Flip Charts	100	0	0
PowerPoint	0	0	100
Video	0	100	0
Internet Access	66	34	0
Self Developed Lesson	100	0	0
Pre-Loaded Activities	17	66	17
Diagrams	50	50	0
Audio	100	0	0
Streaming Video	0	100	0
Animation	100	0	0
Simulation	100	0	0
Games	83	17	0
Hyperlinks	100	0	0

Note. 0 = None, 1 = Rarely, 2 = Occasionally, 3 = Frequently, 4 = Extensively. Observation *N* = 6.

Question 3: What levels of concern, attitudes, and perceptions did teachers indicate toward IWB implementation and use in the sample classrooms?

Stages of Concerns Questionnaire. The overall return rate for the survey was one hundred percent (*n* = 19). Appendix I displays the results of the collected demographic data. Results indicated the majority of the respondents (*n* = 10) had 11-20 years of teaching experience, and 21% (*n* = 4) of the faculty had 21 or more years of teaching experience. The remaining 27% were teachers with 1-10 years of teaching experience. The entire sample of teachers was comprised of females (*n* = 19). Twenty-six percent of the teachers taught 5th grade, where 15% (*n* = 3) taught 2nd grade, 10% taught grades 1st, 6th or 7th and 5% taught kindergarten, 4th or 8th grade. Sixty-three percent (*n* = 12) of the teachers worked in taught Language Arts whereas 37% (*n* = 7) of the sample worked in the taught Math or Science.

Teacher concerns towards the initial use of interactive whiteboards were viewed as an important dimension in implementation process. In this study Stages of Concern data were collected to identify the levels of concern, attitudes, and perceptions did teachers indicated toward IWB implementation and use in the sample classrooms from teachers and analyzed in two ways: Data profiles were developed for the entire cohort as well as for each major subject area including math, science and language arts. An analysis of the entire cohort was used to gain a perspective of the level concerns for all teachers with IWB technology access. Group profiles were generated to gain a perspective of the

level of concern experienced by teachers using interactive whiteboards in different subject areas. Both analyses are presented in this section.

Cohort SoC Profile Analysis

In Figure 1, a profile analysis of the entire sample is displayed. The highest levels of intensity for the teachers were in the categories of Collaboration 64%, Personal 52%, and Information 51%. The lowest level of intensity for the teachers was for the category of Refocusing 30%, indicating that the teachers had a general awareness of the IWB and desired to learn what others knew or were doing through collaborative efforts. These data also indicated teachers were uncertain about their role with the IWB (George et al., 2006).

A high-level Stage 5 concern and a low level Stage 4 concern are clearly illustrated in Figure 1. This type of profile indicates a lack of concern about the direct effects of the interactive whiteboard on students. The high Stage 5 score indicated that respondents' most intense concerns about the interactive whiteboard were about coordinating with others in using it. In addition, Stage 1 and 2 concerns were relatively high. A noticeable tailing up of the profile at Stage 5 is representative of typical "Single-Peak User Profile." Most concern profiles have a single peak at either Stage 3, 4, 5, or 6 (George et. al., 2006, p. 43). The combination of a high Stage 5 concern and a high stage 1 concern suggested a desire to learn from what others knew and were doing, rather than a concern for leading the collaboration.

An interpretation of the high Stage 5 (Collaboration) score could be that teachers were focused on collaborating with peers to expand their knowledge of

the functionality and educational use of interactive whiteboards in the classroom. An interpretation of the high Stage 1 (Information) score could be a lack of understanding about the interactive whiteboard. An interpretation of the high Stage 2 (Personal) score could be that teachers were concerned with the interactive whiteboard's impact on their daily tasks and responsibilities. Because Stage 5, 1 and 2 concerns were high, a possible interpretation was teachers were using the interactive whiteboards while they were still learning to implement the technology into their classrooms based on knowledge primarily acquired through peer collaboration (George et al., 2006, p. 54). Stage 0, 1, 2, and 3 concerns were all within 20 percentile points of Stage 5, the highest stage score. Therefore, these concerns may have accounted for many of the intense concerns of the respondents. Stage 4 and 6 scores were dramatically low. As a group, these teachers reported that they had minimal or no concern in the areas of consequences and refocusing.

Group SoC Profile Analysis

Teachers participating in this study were grouped into three core subject areas, language arts, math and science. Teachers within these subgroups were the first to have IWB systems installed in their classroom therefore; they had full access to IWB technology. A profile analysis was developed for each subgroup. This section contains the results of each profile analysis.

An analysis of the mathematics teachers in the group indicated that Stage 5 concerns were the highest among those teachers. Figure 2 illustrates a high-level Stage 5 concern and a low level Stage 4 concern for Math teachers. This

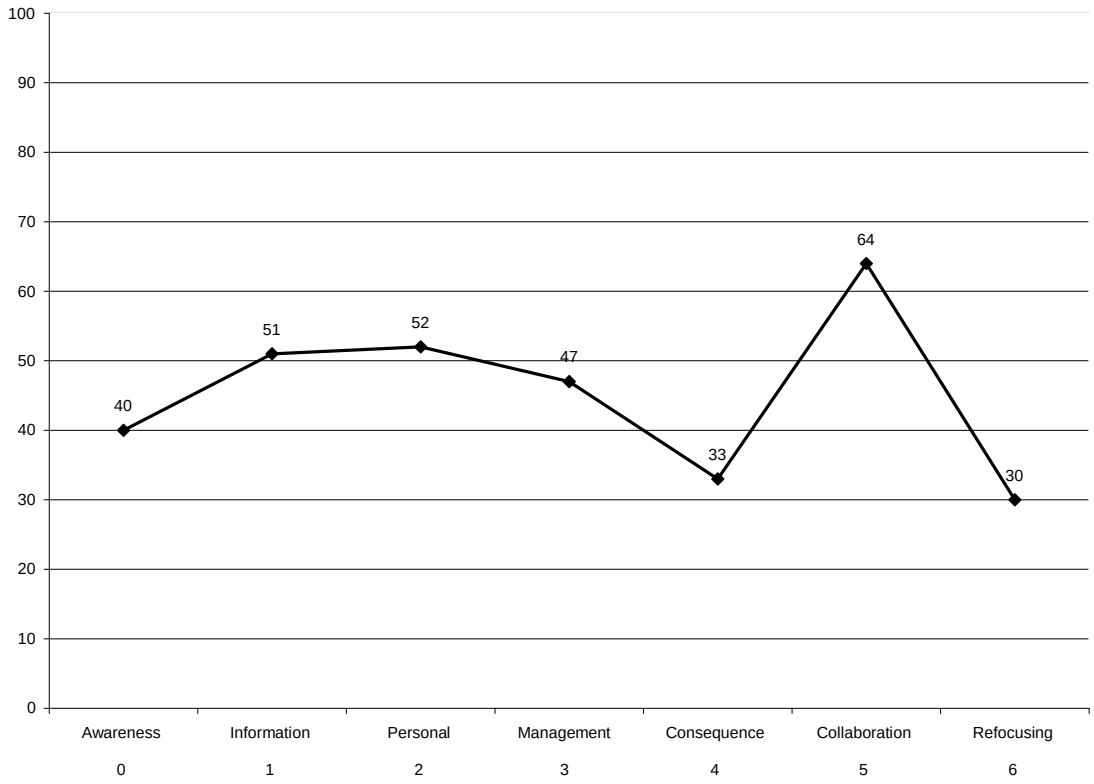


Figure 1. Research sample relative intensity concern profile

type of profile indicates a lack of concern about the direct effects of the interactive whiteboard on students. The high Stage 5 score indicated that respondents' most intense concerns about the interactive whiteboard were about coordinating with others in using it. In addition, Stage 0 and 1 concerns were relatively high. According to George et al., 2006), this may have indicated that the math teachers had little concern about the interactive whiteboard (p. 53). A further interpretation could be that these teachers were more interested in impersonal, substantive aspects of the interactive whiteboard, such as general characteristics, effects, and requirements for use.

An interpretation of the high Stage 5 (Collaboration) score could be math teachers were focused on collaborating with peers to expand their knowledge of the functionality and educational use of interactive whiteboards in the classroom. This interpretation was supported by Stage 0 (Awareness) being the second highest score. An interpretation based on this profile was math teachers were not concerned about the functionality of the interactive whiteboard and may have been leaders in the collaborative efforts to expand the knowledge base of peers on interactive whiteboard use (George et al., 2006, p. 54).

An analysis of science teachers' stages of concerns (see figure 2) revealed high Stage 2, 0 and 5 scores. These scores were within 10 percentile points of the highest Stage score received by math teachers. Stage 4 and 6 scores were both considerably lower than the math and language arts teachers. Figure 2 also illustrates high-level stage 2 concerns and a low-level Stage 4 concerns. The high Stage 0 score on this profile may be an indication that other things, innovations, or activities were of greater concern to the science teachers than the interactive whiteboard (George et al., 2006, p. 53).

An interpretation of the high Stage 2 concern was the science teachers were uncertain about the demands of the interactive whiteboard, their adequacy to meet those demands or their role with the interactive whiteboard. The low Stage 4 score indicates that science teachers had minimal concerns about the effects of the innovation on students. An interpretation of this profile could be that science teachers had feelings of uneasiness regarding the interactive whiteboard; however, this may not have necessarily indicated resistance to using

the technology. The higher concerns for personal effects of using the board could explain the lower level of concerns for student effects (George et al., 2006, p. 53).

Figure 2 also illustrates an analysis of language arts teachers' concerns toward interactive whiteboards. This profile was similar to the profile of math teachers. Stage 5 (Collaboration) appeared to have a higher level of intensity while Stage 4 and 6 scores continued to be the least intense. Stage 0, 1, 2, and 3 scores were within 13 percentile points of each other.

An interpretation of the high Stage 5 (Collaboration) score could be teachers were focused on collaborating with peers to expand their knowledge of the functionality and educational use of interactive whiteboards in the classroom. An interpretation of the high Stage 1 (Information) score could indicate that language arts teachers wanted more information about the interactive whiteboards. An interpretation of the high Stage 3 (Management) could indicate that teachers were focused on the processes and tasks of using the interactive whiteboard and the best use of information and resources for their classrooms. However, issues related to efficiency, organizing, managing, and scheduling were the main focus. Because Stage 5, 1 and 3 concerns were high, a possible interpretation was teachers were using the interactive whiteboards while they were learning to implement the technology into their classrooms. However, implementation of the technology was based on their ability to schedule activities that required the use of the interactive whiteboard (George et al., 2006, p. 54).

In Figure 2, a comparison of subgroups revealed teachers who taught different subjects with IWB technology varied in levels of concern toward the innovation. The relative intensity of teachers' concerns in the math 88% and language arts 64% subgroup's highest levels where toward collaboration while the highest level of relative intensity concern for the science 67% subgroup was toward personal concerns. Secondary levels of intensity for all groups differed. Math 57% and language arts 51% teachers' levels were toward information while science 59% teachers' levels were toward collaboration.

Figure 2 illustrates a high-level stage 5 concern and a low-level Stage 4 concern. This type of profile indicates a lack of concern about the direct effects of the interactive whiteboard on students. The high Stage 5 score indicated that respondents' most intense concerns about the interactive whiteboard were about coordinating with others in using the technology. In addition, Stage 1 and 2 concerns were relatively high. A noticeable tailing up of the profile at Stage 5 was representative of typical "Single-Peak User Profile". However, the combination of a high Stage 5 concern and a high Stage 1 concern suggests a desire to learn from what others know and are doing, rather than a concern for leading the collaboration (George et al., 2006, p. 43).

An interpretation of the high Stage 5 (Collaboration) score could be teachers were focused on collaborating with peers to expand their knowledge of the functionality and educational use of interactive whiteboards in the classroom. An interpretation of the high Stage 1 (Information) score could be teachers lacked an understanding about the functionality of the interactive whiteboard. An

interpretation of the high Stage 2 (Personal) score could be that teachers were concerned with the interactive whiteboard's impact on their daily tasks and responsibilities. Because Stage 5, 1 and 2 concerns were high, a possible interpretation was teachers were using the interactive whiteboards while they were still learning to implement the technology into their classrooms based on knowledge primarily acquired through peer collaboration (George et al., 2006, p. 54).

Stage 0, 1, 2, and 3 concerns were all within twenty percentile points of Stage 5, the highest stage score. Therefore, these concerns may have accounted for many of the intense concerns of the respondents. Stage 4 and 6 scores were dramatically low. As a group, these teachers reported that they had minimal or no concerns in the areas of consequences and refocusing.

Table 7 shows the percentage of teacher participants whose concerns peaked at each of the different stages. Of the 19 teachers, 26%had intense Impact concerns at the Collaboration stage. An additional 16% had high Self level Personal stage concern and 11% had intense Self level Informational Concern. From Table 7, it is evident that as a population or group, teacher participants in this study clustered around having high intensity Stage 5 Collaboration concerns.

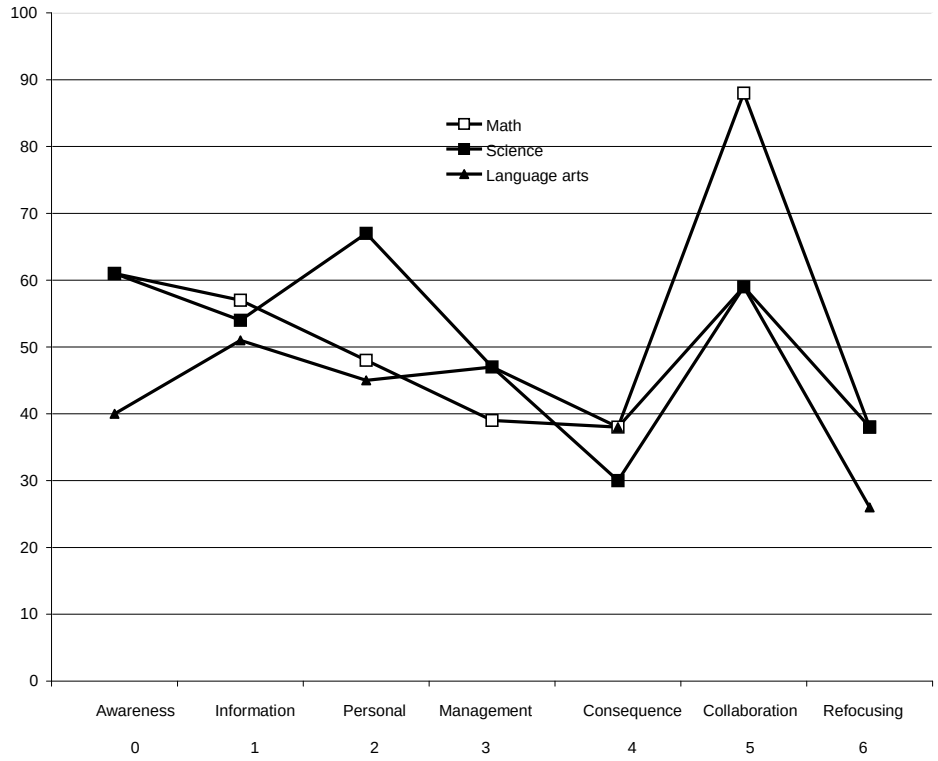


Figure 2. Stages of Concern subgroup comparison of relative intensity toward peak stages of concern.

Table 7

Teacher Population Concerns Clusters (N=19)

Level (Stage of Concern)	*n*	% of Teachers
Awareness	3	5
Self (1-Informational)	2	11
Self (2-Personal)	1	16
Task (3-Management)	4	11
Impact (4 Consequence)	1	5
Impact (5-Collaboration)	8	26
Impact (6-Refocusing)	0	11

Teacher Evaluation Survey. Twenty teachers responded to the open-ended questions contained in the Teacher Evaluation Survey. Survey responses were grouped into three categories; yes, no, and other.

Key questions of relevance to this study included Questions 1, 3, 4, 6, 7, 10, and 13. When asked if teachers imbedded the principles of collaboration and interactivity in the technology application (Question 1), all of the teachers responded with "Yes" or gave a positive indication expressed in terms such as "Absolutely." One teacher's response was:

> The teachers have banded together to build on and raise interest in the use of the IWB. The teachers have teamed together to become proficient in learning new strategies using the IWB.

When asked if the teachers used the equipment to the best of their ability (Question 3), all respondents clearly indicated, "Yes" or gave other affirmations. One teacher's response was:

> Absolutely, but more training is necessary for all of us. I know personally, I am not completely confident with my board and I feel like to use the board properly, I need more training.

All of the surveyed teachers clearly answered "Yes" when asked if the teachers maximize student use of the equipment in the classroom, allowing for active learning, collaboration, critical thinking and problem solving activities (Question 4). One teacher's answer was:

> I have personally tried to get my students on the whiteboard as often as possible since it was installed three months ago. I am still not 100%

> confident in all of the uses of the board. I know that knowledge will come with time and use of the board. One thing is for sure, making your own lessons on the Easiteach is so very time consuming. I use resources that have already been created. There are literally thousands of lessons readily available.

When asked if students were more engaged in the learning process (Question 6), 100% of the teachers' responses were "Yes" or a positive statement such as absolutely.

> Absolutely! Students enjoy interacting with the IWB, and they often cannot take their eyes off what is happening on the screen. They love manipulating the IWB themselves, but it is great to watch the entire class work together to solve problems while engaged in learning all together.

In response to Question 7, all of the teachers indicated "Yes" when asked if they believed student behavior was positively impacted. One teacher indicated that students were better behaved because they were engaged and did not want to miss a turn to come up to the board because they were off task. In addition, 100% of teachers clearly indicated that they felt like students' attention was improved with IWB use (Question 10). Finally, when asked if teachers felt that the new technology improved the variety offered in their rooms (Question 13), 100% clearly indicated, "Yes."

Open-ended survey response statements confirmed teacher concerns at the impact level Collaboration (Stage 5). Teachers within this group placed a high level of importance on their collaborative concerns about IWB adoption.

Teachers reported that “Collaboration with other IWB users was critical and improved confidence in using this technology. Interactivity with students progressed from how to manipulate the boards to the goals embedded in the reinforcement of skills.” Teachers also indicated that working with peers within their own discipline was beneficial to their professional development. “Teachers at different grade levels collaborated on best practices, software and web sites that were helpful.” Teachers also reported interaction in various environments by reporting “Interaction occurred at training sessions at school and at the vender’s location.” “I have received many ideas and activities from my peers.” “Teachers openly assist one another in troubleshooting and developing new lessons.” “This technology encouraged collaboration among the teachers and allows students to be taught in an interactive approach.”

Summary of Results

Research Question 1

1. What instructional strategies were observed in a sample of classrooms equipped with IWB technology and how they compared to CREP norms?

The findings for Research Question 1 may be summarized as follows:

- Direct instruction and teachers acting as coach/facilitator was observed frequently or extensively 100% of the time.
- Items occasionally, rarely or not observed at all, 100% of the time were:
    - Higher level questioning
    - Higher level feedback

- Individual tutoring
- Team teaching
- Cooperative learning
- Ability groups
- Multi-age groups
- Work centers
- Integration of subject areas
- Project based learning
- Parent involvement

Research Question 2

2. What characteristics of an Interactive White-Board were observed being used in a sample of classrooms equipped with IWB technology?

The findings for Research Question 2 may be summarized as follows:

- Teachers were observed using the boards for Internet research, PowerPoint presentation or multimedia displays more often than computer assisted instruction or drill and practice.

Research Question 3

3. What levels of concern, attitudes, and perceptions did teachers indicate toward IWB implementation and use in the sample classrooms?

The findings for Research Question 3 may be summarized as follows:

- Stage 5 (Collaboration) scores were high for the sample of teachers.

- A noticeable tailing up of every profile is evident at Stage 5. One interpretation was that teachers were focused on learning about the interactive whiteboard through collaborative efforts among peers.
- Stage 4 (Consequence) scores were also low on every profile. One interpretation was that teachers were interested in using interactive whiteboards without fully understanding how to use the equipment or what consequences this level of use has on students.
- Teachers were more concerned with learning how to use the technology than how the initial use of the technology would affect the student outcomes.
- Teachers used the interactive whiteboard to add variety to the modes of classroom content presentation.
- One interpretation was the intense concern for collaboration, enhanced the desire to learn more about the interactive whiteboard. The peer collaboration gave teachers a level of comfort that encouraged them to use the boards more frequently.

Chapter 5

Discussion

This chapter is divided into the following sections: summary of the study, summary of the findings, conclusions, recommendations, recommendations for future research, and the chapter summary. The summary of findings section provides a conclusive summary of the quantitative data and the researcher's interpretation of the analysis presented in Chapter 4.

Summary of the Study

The purpose of this study was to investigate the perceptions and attitudes of a select group of teachers toward the implementation of interactive whiteboards. Strategies teachers used with the technology in addition to the associated uses of IWB affordances were investigated.

This study provided insight into one schools implementation of interactive in K-8 classrooms. The information gained through this study could prove to be beneficial to local and state educational administrators by a) describing how teachers in a K-8 school in Tennessee are using interactive whiteboard technology in classrooms, b) the extent to which IWB technology is used, and c) teacher concerns toward IWB technology in the classroom.

Summary of Findings

Nineteen certified teachers with a minimum of one year of teaching experience participated in the study. The School Observation Measure (SOM) and Stages of Concerns Questionnaire (SoCQ) were used to gather descriptive and quantitative self-reported data from these participants. The IWB Teacher

Activity Observation tool and Teacher Evaluation Survey were used to support the finding of the SOM and SoCQ. All respondents were female. The highest percentage (53%) of teachers participating in the study had 11-20 years of teaching experience. Teachers in the fifth grade comprised the largest numbers of participants, totaling 5 (26%). Teachers who taught language arts totaled 12 respondents (63%).

Research Questions

Research Question 1 What instructional strategies were observed in a sample of classrooms equipped with IWB technology and how they compared to CREP norms?

The first research question focused on identifying what strategies a selected sample of teachers used with IWB technology in the classroom. The data from this study indicated that participating teachers used direct instruction (lecture) as an instructional orientation where they acted as coach/facilitator during the instructional activity.

The term direct instruction has both a general and specific meaning. Rosenshine (2008) generally defined direct instruction as any instruction that is led by the teacher regardless of quality. Teachers often use lectures with the IWB to provide instruction, model the skill, give directions and check for pupils' understanding. During the activity, teachers acted as coach or facilitator as students watched presentations or interacted with an activity on the board. This is an indication that teachers linked the interactive capabilities of the IWB with the strategies associated with direct instruction to create learning situations that

incorporated the new technology. Specifically, most of the observed direct instruction resembled that of traditional classroom discourse where the teacher dominated the largest portion of the lesson. However, the whole class setting and use of IWB technology followed patterns indicated by previous research in which this was the most conducive environment for increasing task statements and questions (Galton, Hargreaves, Comber, Wall, & Pell, 1999; Hargreaves et al, 2003; Smith et al., 2004). Nevertheless, the use of task statements and questions were rarely observed.

Data from this study supported prior research citing that direct instruction and teachers acting as coach/facilitator were highly observed in classrooms implementing computer-based technology (Allen, Lowther, Strahl, & Slawson, 2006). The predominant strategies used by teachers were an indication that initial efforts to integrate technology follow similar patterns regardless of the level or type of training received. T.H.E. Journal (2011) suggested the key to implementing interactive whiteboards was training teachers to fully integrate the technology into the curriculum. Teachers in this study received group and individual training from the corporate partner, paired with peers to discover and share instructional strategies, and used online research to learn how to use IWB technology in their classrooms. Initial group training focused on displaying the affordances of the IWB, however, strategies for classroom integration were not introduced. This may have contributed to the lower levels of student engagement when compared the norm data. As teachers become more familiar and

comfortable with an innovation, the use of various strategies should increase (Watson, 2006).

Research Question 2 How were the Interactive whiteboards observed being used in the sample classrooms implementing IWB technology?

Research question two was used to determine the ways a selected sample of teachers used IWB technology in the classroom. Data from this study indicated that teachers used IWB technology as a learning tool or resource more frequently than as a device for instructional delivery. Teachers were observed using the boards more often for Internet research, PowerPoint presentations or multimedia displays rather than computer assisted instruction or drill and practice. Data from the self-evaluation survey indicated that teachers felt they used the technology daily during instructional practices. However, observation data indicated that not all teachers implemented the technology daily.

IWB technology was often used to perform tasks commonly performed on less interactive devices. For example, some teachers used IWBs as projection screens for transparency slides or used as dry erase boards. In other instances, teachers used the IWB as a tool to manage student behavior. Specifically, some teachers indicated that student behavior was positively impacted by the use of IWB technology. In addition, teachers indicated that students behaved in order to get an opportunity to work on the IWB. This may be interpreted as a pattern of beginning technology usage in educational settings. Hooper and Rieber (1995) suggested that if the instructional strategies employed by the teacher are virtually the same as those used before the innovation was introduced, it is very likely that

the teacher's adoption of the innovation will end with integration since nothing has changed or improved.

Research Question 3 What levels of concern, attitudes, and perceptions did teachers indicate toward IWB implementation and use in the sample classroom?

The third research question evaluated the concerns of a selected sample of teachers toward IWB use in the classroom. The data from this study provided four analytical profiles.

Highest Level Concerns of Teachers in the Research Sample

Initial training for the teachers was a generic workshop provided by the vendor to display the features of the interactive whiteboards. Collaboration among peers was introduced as a major component of the teachers' ongoing professional development. Based on data of the entire sample, teachers were mostly concerned about coordinating and cooperating with others regarding the use of IWB technology. One interpretation was teachers believed that collaboration with peers would increase their ability to use IWB technology and promote the instructional use of the equipment. Personal concerns were secondary to collaboration. This suggested that teachers were uncertain about their role with the IWB (George et al., 2008).

Math Subgroup

Data collected from the math subgroup suggested a lower level of concern with regards for direct effects of the interactive whiteboard on students. This was interpreted as teachers having more interest in impersonal, substantive aspects of the interactive whiteboard, such as general characteristics, effects, and

requirements for use (George et al., 2006, p. 54). This may have been a result of teachers attempting to orchestrate the features of the IWB to enhance the presentation of content. Miller, Glover, and Averis (2005) reported that teachers who had consistently used the technology for at least a year were inclined to use manipulations to foster interactivity rather than enhance the presentation.

Science Subgroup

Data collected from the science subgroup, suggested *s*cience teachers were uncertain about the demands of the interactive whiteboard, their adequacy to meet those demands or their role with the interactive whiteboard. The data suggested a lower level of concern with regard to the effects of the innovation on students (George et al., 2006, p. 54). This may have been caused by teachers' interpretation of students' interest in the interactive whiteboard. Most students were eager to participate in lessons involving the whiteboards when the possibility of interacting with the device was present. However, students' levels of interest in the use of the device and lesson may have been different.

Language Arts Subgroup

Data collected from the language arts subgroup, suggested language arts teachers had a lower level of concern with regard for the direct effects of the interactive whiteboard on students. One interpretation was these teachers were more interested in impersonal, substantive aspects of the interactive whiteboard, such as general characteristics, effects, and requirements for use (George et al., 2006, p. 54). This profile was similar to the profile of math teachers. However, the Stage 5 intensity level of math teachers was 24% higher than that of language

arts teachers. However, it is important to note that most of the language arts teachers taught in lower grades. This may have had an impact on the intensity levels of those teachers.

Composite Group Comparison

Based on a comparison of subgroup data, teachers were mostly concerned about coordinating and cooperating with others regarding the use of IWB technology. One interpretation was that teachers believed that collaboration with peers would increase their ability to use IWB technology and wanted to learn from others to enhance the instructional use of the equipment. Personal concerns were secondary to collaboration. This suggested that teachers were uncertain about their role with the IWB. Group analysis also suggested that math teachers were more concerned about the collaboration indicating these teachers may have served a lead role in the professional development among peers. Rakes and Casey (2002) suggested a high Stage 5 typically indicated great concern about coordination with others in relation to the innovation. In addition, a high Stage 1 most likely indicated that concerns about looking for ideas from other, reflected more of a desire to learn from what other teachers knew and were doing, rather than concern for collaboration.

The emergence and resolution of concerns about innovations appear to be developmental, in that earlier concerns must first be resolved before later concerns can emerge (George et al., 2006 p. 35). Data from this study supports this pattern of development in teacher concerns. Impact level consequence (Stage 4) concerns had the lowest reported intensity level. This indicates that the

impact of IWB technology on students in their immediate sphere of influence was of low concern. Considerations include: the relevance of the innovation for students; the evaluation of student outcomes, including performance and competencies; and the changes needed to improve student outcomes. Naylor (2001) reported that unmet needs of students was a concern of teachers and listed as one of the top producers of teacher anxiety by the British Columbia Teacher's Federation in Canada. Rakes and Casey (2002) suggested that a low Stage 4 indicated that the respondents had minimal to no concern about the relationship of students to the use of the innovation. One interpretation of the analysis from this study was teachers had minimal concerns toward how the technology would affect the students' outcomes due to their preoccupation with learning how to use the technology.

Conclusions

Overall, the findings of this study offer many implications for educational professional development. Based on specific findings the following conclusions were warranted:

1. Teachers in initial stages of interactive whiteboard implementation used direct instruction and acting as coach/facilitator as instructional strategies.

2. Teachers in initial stages of IWB adoption use basic office applications more often than the unique affordances of IWB systems.

3. During the initial stages of IWB adoption, relative intensity levels toward collaboration were high.

4. The emergence and resolution of concerns about interactive whiteboards appear to follow developmental patterns indicated in prior research.

High Levels of Concern during Initial Stages of IWB Adoption

During this study, survey results indicated high levels of teacher concerns toward collaboration. The lowest level of intensity for the teachers was for the category of refocusing; indicating that the teachers had a general awareness of the IWB and desired to learn what other teachers knew or were doing through collaborative efforts. Campus administrators promoted the use of collaboration for professional development. Teachers also felt that peer collaboration was an excellent way to share and communicate ideas in efforts to increase IWB use in the classroom. Much of the professional development was conducted using collaborative methods. Teachers often gathered data from Internet sources and shared their findings with peers. Although teachers were able to find additional content, lessons, and information on the use of IWB systems, effective modeling was often missing from the developmental efforts.

Emergence and Resolution of Concerns

George et al. (2006) argued that earlier concerns must first be resolved before later concerns can emerge. Teachers in this study were not new technology users, although they were novice in the use of IWB systems. The emergence of early stage concerns may have been resolved before the start of this study as teachers were comfortable using innovative equipment. Nevertheless, teachers displayed a high level of interest toward collaborative

professional development efforts. What is not clear is whether teachers were intrinsically or extrinsically motivated to participate in collaborative efforts.

Most used Instructional Strategies

This study provided an opportunity to observe the initial instructional strategies used most often by teachers who recently had IWB systems installed in their classrooms. These teachers had full access to interactive whiteboard technology in their classrooms; however, all of the teachers were considered new users of the technology. To gain a perspective of the instructional strategies used by teachers, the research design targeted the approach teachers used to implement the new technology into their lessons. The current study emphasized the observation of instructional strategies used in conjunction with IWB technology. As indicated in other studies, teachers chose to use direct instruction (DI) and act as coach or facilitator when using IWB systems. Teachers were often observed using the board to present introductory lesson content, but the board was rarely used for the student activities. The use of DI may have been used to guide teachers while implementing the new technology. The ability to subscribe to a rigid plan, which included IWB specific tasks, may have assisted teachers in both using the affordances of the IWB and overcoming concerns with implementing the new technology into classrooms.

Teachers' Use of IWB Systems

During the initial stages of implementation, teachers were observed using IWB technology for routine technological tasks more often than for interactive learning experiences. IWB technology was used to accomplish tasks that could

have been accomplished using less innovative equipment. Even though features of IWB use were modeled during the initial training, teachers did not have an opportunity to see the features modeled in ways that were relevant to their instructional practices. Teacher did use pre-developed lessons within their classrooms; however, these activities were supplemental to their lesson, at best. Nevertheless, teachers were using the features of the IWB with the belief that practice and experience would eventually lead to the ability to implement the technology in a useful manner.

Recommendations

This study offers several recommendations to local education leaders who seek to implement interactive whiteboard technology in classrooms. Based on the findings from this study the following recommendations are proposed:

1. Teachers with IWB equipped classrooms use direct instruction strategies where they can coach and facilitate learning in their classrooms. Direct instruction, as a teaching strategy, is fast paced and provides constant interaction between students and the teacher. However, IWB features should be used to enhance learning and bring balance to the instructional pace.

2. Teachers in this study had intense concerns toward collaboration, because it was a major part of their professional development. Teachers agreed that collaboration with peers was an important aspect of their training. Once teachers receive basic skills training, peer mentoring and collaboration should be the focus of continuing professional development.

Recommendations for Future Studies

The conclusion of this study offers several recommendations for future research. Based on previous research and the findings from this study, the following recommendations are proposed for further study:

1. The field of educational research would benefit from conducting longitudinal studies of schools in the initial stages of IWB adoption.

2. This study should be continued to observe and record the changes in teacher concerns over an extended time.

3. Applications of the same research design to other schools would prove beneficial to the state and federal departments of education, in promoting collaborative professional development models.

Summary

The conclusions reached during this study may be initially interpreted as negative; however, the results follow similar patterns found in previous studies. It is an important consideration when planning professional development to be aware of teacher concerns. Training and development should be related to teacher concerns if training is going to be meaningful and innovation adoption sustained (Hall & Hord, 2001). Results from this study should prove beneficial to educational leaders in structuring professional development models that will enhance the adoption and implementation of IWB technology in classrooms. During the initial stages of interactive whiteboard implementation, teaching strategies did not immediately transform from traditional to social interactive. Lectures and teachers acting as coach or facilitator were highly observed as

teachers used interactive whiteboards in their classroom. Although this form of use did not incorporate the interactive features of the IWB into the instruction, it did provided teachers with the opportunity to gain active experience while learning to integrate IWB features. This active experience was beneficial to teachers as they later collaborated to develop and encourage effective IWB use among peers. When teachers are introduced to the initial affordances of IWB technology, it is important that they observe the modeled use of the affordances in practical instructional scenarios. Without professional development that includes the modeled use of effective instructional strategies and IWB affordances, teacher will use the technology in ways that resemble traditional teaching with less interactive tools and methods. Peer collaboration may have been the most beneficial facet of the professional development. Peer collaboration provided teachers the opportunity to model and share instructional strategies that were used successfully in classrooms. The significance of this study is supported by the continuous improvements in professional development and IWB adoption seen in classrooms.

IWB technology was mainly used a presentation device to facilitate group lectures or motivate students through the use of educational games or media for initial entertainment. The IWB was used to present PowerPoint presentations or scanned documents. During most observations, the teacher facilitated the lesson using these forms of media by lecturing or annotating over the scanned document. This form of use limited both the opportunities to use some of the more basic features of the system and engage students through interaction with

the IWB. This researcher felt that teachers needed to engage students not only through physical interaction with the board, but also with higher order questioning and discussion with the IWB used to supplement the discussion.

Teacher concerns were viewed as a critical component to the successful progression of IWB implementation during this study. Teachers in this study were not new technology users, although they were novice in the use of IWB systems. The emergence of early stage concerns may have been resolved before the start of this study as teachers were comfortable using innovative equipment. Nevertheless, teachers displayed a high level of interest toward collaborative professional development efforts. The high level of teacher interest in conjunction with a high level of administrative support for active learning seemed to created an environment that fostered positive peer collaboration and professional development.

As indicated by Barron et al., (2003), it will be important to revisit in the future those teachers who are currently reporting a variety of low-level uses to see if changes occur. If changes do occur, researchers must use this data to determine the factors that initiated and supported the change. This study has contributed to an understanding of the concerns teachers have during the initial stages of IWB adoption. The results of this study are consistent with previous research in the areas of innovation adoption. This study adds to the existing body of literature that addresses questions of technology adoption and teacher concerns.

References

Allen, L., Lowther, D. L., Strahl, D. J., & Slawson, D. (2006). West Orange Collaborative STARK Program 2001-2006 Evaluation Report. Center for Research in Educational Policy, Memphis, TN.

Armstrong V., Barnes, S., Sutherland, R., Curran, S., Mills, S., & Thompson I. (2005). Collaborative research methodology for investigating teaching & learning: The use of interactive whiteboard technology. *Educational Review, 57*(4), 455-467.

Atkinson, R. K., & Renkl, A. (2007). Interactive example-based learning environments: Using interactive elements to encourage effective processing of worked examples. *Educational Psychology Review, 19*(3), 375-386.

Barron, A. E., Kemker, K., Harmes, C., & Kalaydjian, K. (2003). Large-scale research study on technology in K-12 schools: Technology integration as it relates to the National Technology Standards. *Journal of Research on Technology in Education, 35*, 489-507.

Barucky, J. M. (1984). *Identification and measurement of the personal leadership development concerns of Air Force officers, cadets, and trainers participating in Air Force professional military education programs.* Unpublished doctoral dissertation, University of Texas at Austin.

Beauchamp, G., & Kennewell, S. (2009). Interactivity in the classroom and its impact on learning. *Computers & Education*.

Beauchamp, G., & Parkinson, J. (2005). Beyond the 'wow' factor: Developing interactivity with the interactive whiteboard. *School Science Review 86*(316), 97-103.

Bebell, D., Russell, M., & O'Dwyer, L. M. (2004). *The USEIT Report 12: Measuring Teachers' Technology Uses: Why Multiple-Measures Are More Revealing.* Boston, MA: Technology and Assessement Study. Retrieved July 6, 2010 from http://www.intasc.org/PDF/useit_r12.pdf

Beeland, Jr. W. D. (2002). Student engagement, visual learning and technology: Can interactive whiteboards help? Retrieved Oct 17, 2009, from http://chiron.valdosta.edu/are/Artmanscrpt/vol1no1/beeland_am.pdf

Bell, M. A. (2002). Why use an interactive whiteboard? A baker's dozen reasons: Retrieved June 16, 2005, from http://teachers.net/gazette/JAN02

Bui, V. (2009). Interactive whiteboard effects on education. *National Institute of Building Technologies.* Retrieved February 26, 2011, from http://www.edfacilities.org/rl/interactive_whitebaords.cfm

Cates, G.L., Skinner, C. H., Watson, S.T., Meadows, T.J., Weaver, A., & Jackson, B. (2003). Instructional effectiveness and instructional efficiency as considerations for data-based decision making: An evaluation of interspersing procedures. *School Psychology Review, 32*(4)*, 601-617.*

Christiansen, R. (2002). Effects of technology integration education on the attitudes of teachers and students. *Journal of Technology and Teacher Education 14*(2), 363-385.

Cogill, J. (2002). How is the interactive whiteboard being used in primary school and how does this affect teachers and teaching? Becta Research Bursary. Retrieved December 12, 2009, from www.virtuallearning.org.uk/whiteboards/ifs_interactive_whiteboards_in_the_primary_school.pdf

Cox, M., Abbott, C., Webb, M., Blakeley, B., Beauchamp, T., & Rhodes, V. (2004) ICT and attainment: A review of the research literature. Becta. Retrieved October 24, 2009 from http://partners.becta.org.uk/upload-dir/downloads/page_documents/research/ict_attainment_summary.pdf

Creswell, J.W. (2007). Qualitative inquiry and research design: Choosing among five traditions (2nd Ed). Thousand Oaks, CA: Sage

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). *High access and low use of technologies in high school classrooms: Explaining an apparent paradox. American Educational Research Journal, 38*(4), 813-834.

Davison, I., & Pratt, D. (2003). An investigation into the visual and kinesthetic affordances of interactive whiteboards. In British Educational Communication and Technology Agency, ICT research bursaries: A compendium of research reports. A report on the ICT Research Bursaries 2002-03 (ICT in schools research and evaluation series, No.16 pp 29-33). London: DfES. Retrieved October 18, 2009 from http://www.becta.org.uk/page_documents/research/bursaries_report.pdf

de Castell, S., & Jenson, J. (2004). Paying attention to attention: New economies for learning. *Educational Theory, 54*(4), 381-397.

Deubel, P. (2007). The great debate: Effectiveness of technology in education. The Journal. Retrieved from http://thejournal.com

Ertmer, P. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*(4), 47-61.

Ertmer, P. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development, 53(4), 25-39.*

Executive Office of the President. (2010). A new foundation for 21st century learning: Education technology investments in the 2011 budget. Retrieved February 5, 2010 from http://www.whitehouse.gov/sites/default/files/edtechfinal.pdf

Feagin, J., Orum, A., & Sjoberg, G. (Eds.). (1991). *A case for case study*. Chapel Hill, NC: University of North Carolina Press.

Franklin, T., Turner, S., Kariki, M., & Duran, M. (2001). Mentoring overcomes barriers to technology integration. *Journal of Computing in Teacher Education, 18*(1), 26-31.

Faust, J., & Paulson, D. (1998). Active learning in the college classroom. *Journal on Excellence in College Teaching, 9*(2), 3-24.

Galton, M., Hargreaves, L., Comber, C., Wall, D., & Pell, T. (1999). Changes in patterns of teacher interaction in primary classroom*. British Educational Research Journal, 25*(1), 23-37.

George, A. A., Hall, G. E., & Stiegelbauer, S. M. (2006). *Measuring Implementation in Schools: The Stages of Concern Questionnaire*. Southwest Educational Development Laboratory (SEDL), Austin, TX.

Gillen, J., Staarman, K. J., Littleton, K., Mercer, N., & Twiner, A. (2007). A "learning Revolution? Investigating pedagogic practice around interactive whiteboards in British primary classrooms. *Learning, Media and Technology, 3*2(3), 243-256.

Glover, D., & Miller, D. (2002). The interactive whiteboard as a force for pedagogic change: The experience of five elementary schools in an English education authority. *Information Technology in Childhood Education Annual 2002*(1), 5-19.

Glover, D., Miller, D., Averis, D., & Door, V. (2007). The evolution of an effective pedagogy for teachers using the interactive whiteboard in mathematics and modern languages: an empirical analysis from the secondary sector. Retrieved April 18, 2011, from http://www.keele.ac.uk/depts/ed/iaw/docs/IAWResearch.pdf

Grant, M. M., Ross, S. M., Wang, W., Potter, A., & Wilson, Y. (2004). Riverdale elementary "learning without limits" 2003-2004 evaluation report. Memphis, TN: Center for Research in Educational Policy. (ERIC Document Reproduction Service No. ED484278)

Gray, G., Hagger-Vaughan, Pilkington, R., & Tomkins, S-A. (2005). The pros and cons of interactive whiteboards in relation to the key stage 3 strategy and framework. *Language Learning Journal, 32*, 38-44.

Haldane, M. (2007). Interactivity and the digital whiteboard: Weaving the fabric of learning. *Learning, Media and Technology, 32*(3), 257-270.

Hall, G. E., George, A. A., & Rutherford, W. L. (1977). Measuring stages of concern about the innovation: A manual for use of the SoC questionnaire. Austin: Research and Development Center for Teacher Education, University of Texas. (ERIC Document Reproduction Service No ED147342)

Hall, G. E., & Hord, S. M. (1987). *Change in schools: Facilitating the process*. New York: State University of New York Press.

Hall, G. E., & Hord, S. M. (2001). *Implementing change: Patterns, principles, and potholes.* Boston: Allyn and Bacon.

Hall, G. E., Newlove, B. W., George, A. A., Rutherford, W. L., & Hord, S. M. (1991). *Measuring change facilitator Stages of Concern: A manual for use of the CFSoC Questionnaire.* Greely: Univeristy of Northern Colorado, Center for Research on Teaching and Learning.

Hall, G. E., R. C. Wallace, & W. A. Dossett. (1973). A Developmental Conceptualization of the Adoption Process Within Educational Institutions. Austin, TX: Research and Development Center for Teacher Education, University of Texas.

Hall, I., & Higgins, S. (2005). Primary school students' perceptions of interactive whiteboards. *Journal of Computer Assisted Learning, 21*, 102-117.

Hargreaves, L., Moyles, J., Merry, R., Paterson, F., Pell, A., & Esare-Sarries, V. (2003). How do primary school teachers define and implement interactive

teaching in the National Literacy Strategy in England. *Research Papers in Education, 18*(3), 217-236.

Hennessey, S., Deaney, R., Ruthven, K., & Winterbottom, M. (2007). Pedagogical strategies for using the interactive whiteboard to foster learner participation in school science. *Learning, Media and Technology, 32*(3), 283-301.

Hennessy, S., Wishart, J., Whitelock, D., Deaney, R., Brawn, R., la Velle, L., McFarlane, A., Ruthven, K., & Winterbottom, M. (2007). Pedagogical approaches for technology-integrated science teaching. *Computers & Education, 48*, 137-152.

Herschbach, D. R. (1992). Technology and Efficiency: Competencies as content. *Journal of Technology Education 3*(2). Retrieved June 16, 2010, from http://scholar.lib.vt.edu/ejournals/JTE/v3n2/html/herschbach.html

Hew, K.F., & Brush, T. (2007). Integrating technology into k-12 teaching and learning: current knowledge gaps and recommendations for future research. *Educational Technology Research and Development, 55*(3), 223-252.

Higgins, S., Beauchamp, G., & Miller, D. (2007). Reviewing the literature on interactive whiteboards. *Learning Media and Technology, 32*(3), 213-225.

Hodge, S., & Anderson, B. (2007). Teaching and learning with an interactive whiteboard: A teacher's journey. *Learning, Media and Technology, 32*(3), 271-282.

Hokanson, B., & Hooper, S. (2004). Integrating technology in classrooms: We have met the enemy and he is us. Paper presented at the Annual Meeting of the Association for Educational Communications and Technology, Chicago: IL. retrieved December 28, 2010 from http://hokanson.cdes.umn.edu/publications/IntegratingAECT.pdf

Holland, P. E. (2001). Professional development in technology: Catalyst for school reform. *Journal of Technology and Teacher Education, 9*(2), 245-267.

Hooper, S., & Rieber, L.P. (1995). Teaching with technology. In A. C. Ornstein (Ed.), Teaching: Theory not practice (pp. 154-170). Needham Heights, MA; Allyn and Bacon.

Jewitt, C., Moss, G., & Cardini, A. (2007). Pace, interactivity and multimodality in teachers' design of texts for interactive whiteboards in secondary classroom. Learning, *Media and Technology*, *32*(3), 303-317.

Jonassen, D.H. (1995). Computers as cognitive tools: Learning with technology, not from Technology. *Journal of Computing in Higher Education, 6*(2), 40-73.

Jordan-Marsh, M. (1985). Development of a tool for diagnosing changes in concern about exercise: A means of enhancing compliance. *Nursing Research, 34(2), 103-107.*

Judson, E. (2006). How teachers integrate technology and their beliefs about learning: Is there a connection? *Journal of Technology and Teacher Education, 14*(3), 581-597.

Kennewell, S., & Beauchamp, G. (2007). The features of interactive whiteboards and their influence on learning. *Learning, Media and Technology, 32*(3), 227-241.

Kennewell, S. (2005). Interactive teaching with interactive whiteboards. World Conference on Computers in Education. Retrieved Oct 17 from http://hdl.handle.net/2428/49593

Kennewell, S. (2004). Researching the influence of interactive presentation tools on teachers' pedagogy. *Paper presented at the British Educational Research Association Conference*, UMIST, Manchester, September.

Kennewell, S., & Morgan, A. (2003). Student teachers' experience and attitudes towards using interactive whiteboards in the teaching and learning of young children. Retrieved October 17, 2009 from http://crpit.com/confpapers/CRPITV34Kennewell1.pdf

Kitson, L., Fletcher, M., & Kearney, J. (2007). Continuity and change in literacy practices: A move towards multiliteracies. *Journal of Classroom Interaction 41*(2), 29-41.

Kolb, S. E. (1983). *Development and application of a questionnaire for assessing Stages of Concern among nurses*. Unpublished doctoral dissertation, University of Texas at Austin.

Lerman, S., & Zevenbergen, R. (2007). Interactive whiteboards as mediating tools for teaching mathematics: Rhetoric or reality? *Proceedings of the 31st Conference of the International Group for Psychology of Mathematics Education, 3,* 169-176.

Levin T., & Wadmany, R. (2006). Teachers' beliefs and practices in technology-based classrooms: *A developmental view. Journal of Research on Technology in Education, 39*(2), 157-181.

Loucks-Horsley, S., & Matsumoto, C. (1999), Research on Professional Development for Teachers of Mathematics and Science: The State of the Scene. School Science and Mathematics, 99: 258–271.

Lopez, O.S. (2009). The digital learning classroom: Improving English language learners' academic success in mathematics and reading using interactive whiteboard technology. *Computers & Education*, *54*(4), 901-915.

Low, R., & Sweller, J. (2005). The modality principle in multimedia learning. In R. E. Mayer (Ed.), *The Cambridge Handbook of Multimedia Learning.* New York: Cambridge University Press.

Liu, C. H., & Mathews, R. (2005). Vygotsky's philosophy: Constructivism and its criticisms examined. *International Education Journal, 6*(3), 386-399.

Machin, S., McNally, S., & Silva, O. (2007). New technology in schools: Is there a payoff? *Economic Journal, Royal Economic Society, 117*(522), 1145-1167.

Manzo, K. K. (2010). Beyond teacher chalk talk. *Education Week Digital Directions, 3(2), 34.*

Martin, J. B. (1989). *Measuring the Stages of Concern in the development of computing expertise.* Unpublished doctoral dissertation, University of Florida.

Mayer, R. E. (2001) *Multimedia Learning.* New York: Cambridge University Press.

Mayer, R. E. (2005) *The Cambridge Handbook of Multimedia Learning.* New York: Cambridge University Press.

Michael, J. (2006). Where's the evidence that active learning works? *Advances in Physiology Education, 30*, 159-167.

Miller, D., Glover, D., & Averis, D. (2005). Presentation and pedagogy: The effective use of interactive whiteboards in mathematics lesson', in D. Hewitt & A. Noyes (Eds), *Proceedings of the sixth British Congress of Mathematics Education* held at the University of Warwick, (pp. 105-112). Available from www.bsrlm.org.uk

Miller, D.J., Glover, D. C., & Averis, D. (2004). Enhancing mathematics teaching through new technology: The use of the interactive whiteboard. Retrieved October 30, 2009 from http://www.keele.ac.uk/dept/ed/iaw/nuffield.htm

Miller, D., & Glover, D. (2007). Into the unknown: The professional development induction experience of secondary mathematics teachers using interactive whiteboard technology. *Learning, Media and Technology, 32*(3), 319-331.

Miller, D.J., & Glover, D. (2006). Interactive whiteboard evaluation for the secondary national strategy: Developing the use of interactive whiteboards in mathematics, Final Report for the Secondary National Strategy. Available at: http://www.standards.dfes.gov.uk/keystage3/downloads/ma_iaw_eval_rpt.pdf

Moreno, R. (2007). Optimizing learning from animations by minimizing cognitive load: Cognitive and affective consequences of signaling and segmentation methods. *Applied Cognitive Psychology, 21,* 765-781.

Moss, G., Jewitt, C., Levacic, R., Armstrong, V., Cardini, A., & Castle, F. (2007). *The interactive whiteboards, pedagogy and pupil performance evaluation: An evaluation of the School Whiteboard Expansion (SWE) Project: London challenge.* London: Institute of Education.

National Center for Technology in Education. (2008). Interactive Whiteboards. *NCTE Advice Sheet 16*, 1-7.Retrieved June 13, 2011 from www.ncte.ie/documents/advicesheets/16InteractiveWBsNov08.pdf

Naylor, C. (2001). *Teacher workload and stress: An international perspective on human costs and systemic failure.* BCTF Research Report. Retrieved April 25, 2011, from http://eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/19/fc/68.pdf

Nist, L., & Joseph, L. (2008). Effectiveness and efficiency of flashcard drill instructional methods on urban first-grader' word recognition, acquisition, maintenance, and generalization. *School Psychology Review, 37*(3), 294-308.

Painter, D., Whiting, E., & Wolters, B. (2005). The use of interactive whiteboard in promoting interactive teaching and learning. *Virginia Society for Teaching in Education, 19* (2), 31-40.

Rakes, G. C., & Casey, H.B. (2002). An analysis of teacher concerns towards instructional technology. *International Journal of Educational Technology, 3*(1). Retrieved March 8, 2011 from http://www.ed.uiuc.edu/ijet/v3n1/rakes/index.html

Rakes, G.C., Fields, V.S., & Cox, K.E. (2006). The influence of teachers' technology use on instructional practices. *Journal of Research on Technology in Education, 38* (4), 409-424.

Richardson, A. (2002). Effective questioning in teaching mathematics using an interactive whiteboard. *Micromath, 18*(2), 8-12.

Rosenshine, B. (2008). Five meanings of direct instruction. Retrieved September 1, 2010 from http://centerii.org/techassist/solutionfinding/resources/FiveMeaningsOfDI.pdf

Ross, S. M., Smith, L. J., & Alberg, M. (1999). *The School Observation Measure (SOM©)*. Memphis, TN: Center for Research in Educational Policy, The University of Memphis.

Rudd, T. (2007). Do whiteboards have a future in the UK classroom? *Futurelab: Innovation in education*. Retrieved October, 30, 2009 from http://www.futurelab.org.uk/events/listing/whiteboards/report

Ryan, B., & Cowie, B. (2009). Exploring the use of interactive whiteboard in a primary science classroom. *Set: Research Information for Teachers*, *1*, 43-48.

Schacter, J. (1999). The impact of education technology on student achievement. Santa Monica CA: The Milken Exchange on Education Technology. (ERIC Document Reproduction Service No. ED430537)

Schmid, E.C. (2008). Potential pedagogical benefits and drawbacks of multimedia use in the English language classroom equipped with interactive whiteboard technology. *Computers & Education, 51*, 1553-1568.

Sivin-Kachala, J., Bialo, E., & Rosso, J. L. (2000). Online and electronic research by middle school students. Sanata Monica, CA: Milken Family foundation. Retrieved June 19, 2010 from http://www.mff.org/pubs/IESDReport.pdf

Slay, H., Sieborger, I., & Hodgkinson-Williams, C. (2008). Interactive whiteboards: Real beauty or just “lipstick”? *Computers & Education, 51*, 1321-1341.

SMART Technologies Inc. (2006). Interactive whiteboards and learning: Improving student learning outcomes and streamlining lesson planning. Retrieved December 2009 from: http://www2.smarttech.com/st/en-US/Resourcelibrary/Publications/white+papers/defaultAjax/Improving+Student+Learning+Outcomes.htm

Smith, F., Hardman, F., & Higgins, S. (2006). The impact of interactive whiteboards on teacher-pupil interactions in the national literacy and numeracy strategies. *British Educational Research Journal, 32*(3) 443-457.

Smith, F., Hardman, F., Wall, K., & Mroz, M. (2004). Interactive whole class teaching in the National Literacy and Numeracy Strategies. *British Educational Research Journal, 30*(3), 395-411.

Somekh, B., Lewin C., Mavers, D., Fisher T., Harrison, C., et al. (2002) ImpaCT2 Pupils' and Teachers' Perceptions of ICT in the Home, School and Community, UK: Becta

Somyurek, S., Atasoy, B., & Ozdemir, S. (2009). Board's IQ: What makes a board smart? *Computers & Education, 53*, 368-374.

Strehle, E. L., Whatley, A., Kurz, K.A., & Hausfather, S. J. (2002). Narratives of collaboration: Inquiring into technology integration in teacher education. *Journal of Technology and Teacher Education, 10*(1), 27-47.

Tanner, H., Kennewell, S., Jones, S., & Beauchamp, G. (2005). Interactive whole class teaching and interactive whiteboards, 720-727. Retrieved October, 30, 2009 from www.merga.net.au/documents/RP832005.pdf

T.H.E. Journal. (2011). *Leveraging interactive whiteboards as a core classroom technology* (White paper). Retrieved from http://thejournal.com/whitepapers/2011/06/smart-technologies_interactive-whiteboards.aspx

Torff, B., & Tirotta, R. (2009). Interactive whiteboards produce small gains in elementary student's self-reported motivation in mathematics. *Computers & Education*. Article in press.

U.S. Department of Education. *National Center for Education Statistics. (2000). Teachers Tools for 21st Century: A Report on Teachers' Use of Technology.* Washington, DC.

Van Merrienboer, J.J.G., & Sweller, J. (2005). Cognitive load theory and complex learning: Recent developments and future directions. *Educational Psychology Review, 17*(2), 147-178.

Vygotsky, L. S. (1978). Mind in socieity. Cambridge, MA: Harvard University Press.

Watson, G. (2006). Technology professional development: Long term effects on teacher self-efficacy. *Journal of Technology and Teacher Education, 14*(1), 151-165.

Williams, D., Coles, L., Wilson, K., Richardson, A., & Tuson, J. (2000). Teachers and ICT: Current use and future needs. *British Journal of Educational Technology, 31, 307-320.*

Windschitl, M., & Sahl, K. (2002). Tracing teachers' use of technology in a laptop computer school: The interplay of teacher beliefs, social dynamics and institutional culture. *American Educational Research Journal, 39*(1), 165-205.

Wood, R., & Ashfield, J. (2008). The use of interactive whiteboard for creative teaching and learning in literacy and mathematics: A case study. *British Journal of Educational Technology, 39*(1), 84-96.

Wozney, L., Venkatesh, V., & Abrami, P. (2006). Implementing computer technologies: Teachers' perceptions and practices. *Journal of Technology and Teacher Education, 14*(1), 173-207.

Yin, R. K. (2003). Case study research, design and methods, 3rd ed. Newbury Park: Sage Publications.

Zevenbergen, R., & Lerman, S. (2007). Pedagogy and interactive whiteboards: Using an activity theory approach to understand tensions in practice. In K. Beswick (Ed.) Proceedings of the 30th Annual Conference of the Mathematics Education Group of Australasia. MERGA: Hobart.

Appendix A

Invitation Letter

Dear Teacher:

I am Corey Johnson from The University of Memphis.

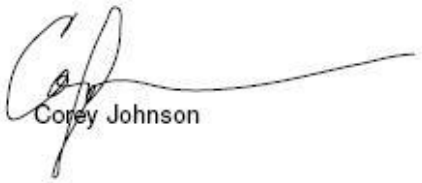
I will be observing your class as part of your school's evaluation of its school wide integration of Interactive Whiteboards. I will be visiting different classes in the school for about 15 minutes each, to obtain an impression of the types of teaching and class activities that take place.

You are not being evaluated as an individual teacher, and, your name or individual classroom observation data will NOT be identified in any report. Reporting will be done on a whole-school basis.

It may be helpful for me to talk with you briefly on the day of observation if I have any questions about what I observed. If so, I will try to determine when you might have a few minutes of free time.

Thank you for allowing me to visit your classroom.

Sincerely,



Corey Johnson

Appendix B

School Observation Measure (SOM) Permission to Use

Corey Johnson

From: Deborah Lowther (dlowther) [dlowther@memphis.edu]
Sent: Monday, March 29, 2010 12:08 PM
To: Corey Johnson
Cc: Jack Daniel Strahl (jstrahl)
Subject: Permission to use CREP's School Observation Measure

Corey,
Thank you for your interest in using the Center for Research in Educational Policy's (CREP) School Observation Measure (SOM) as a data collection instrument for your dissertation. Please accept this email as evidence of your permission to use the SOM according to CREP guidelines, as noted in the SOM Observer's Manual.

Please use the following citation when referencing the SOM in your dissertation:
(Ross, Smith, & Alberg, 1999)

Add the following to your Reference Section:
Ross, S. M., Smith, L. J., & Alberg, M. (1999). *The School Observation Measure (SOM®)*. Memphis, TN: Center for Research in Educational Policy, The University of Memphis.

When using a table to report SOM results, add an asterisk after the name (SOM*) in the title and the following below the table: *Used with permission from the Center for Research in Educational Policy, The University of Memphis.

Please let me know if you have questions.
Dr. Lowther
Senior Associate Director, CREP

Deborah L. Lowther, Ph.D.
First Tennessee Professor
Instructional Design and Technology
http://idt.memphis.edu/
The University of Memphis
College of Education
415C Ball Hall Memphis, TN 38152
Phone: 901-678-5645
Email: dlowther@memphis.edu

Appendix C

School Observation Measure (SOM) Notes and Summary Forms

"SOM"ary of Terms

Instructional Orientation

Direct Instruction (lecture)
- Teacher controlled
- Entire class or small group
- Academic focus
- Lecture format

Team Teaching
- More than one teacher
- If teacher assistant (or non-certified individual), must be in teaching role
- Certified teachers do not have to teach simultaneously, but both must be present and responsible

Cooperative [RSCA]/Collaborative Learning
- Small groups interacting
- Partner reading
- Emphasis (time) is the orientation, not quality
- Learning to cooperate

Individual Tutoring (teacher, peer, aide, adult volunteer)
- Students receive 1:1 help
- Planned context
- Tutor and tutee roles clearly pre-established

Classroom Organization

Ability Groups
- Differentiated instruction based on performance level (within class or entire class)
- Note details from teacher or principal

Multi-age/Multi-grade Grouping
- Note details from teacher or principal

Work Centers (for individuals or groups)
- Observed use of designated spaces containing special materials
- Reading rug

Instructional Strategies

Higher-Level Instructional Feedback to Enhance Student Learning (written or verbal)
- Providing answers and information relative to progress in learning
- Goes beyond "correct" or "incorrect"
- Gives explanation, new information
- Motivational responses are not considered instructional feedback

Integration of Subject Areas (interdisciplinary/thematic units)
- Planned or explicit overlap of knowledge from different subjects
- Often occurs in thematic units/project-based learning or oriented to a guiding question that is ongoing and tangible to students

Project-based Learning [RSCA] (Examples: Application, analysis, synthesis, or evaluation)
- An inquiry or question guides the production of authentic work
- Key factors:
  - Planned
  - Long-term
  - Tangible products
  - Culminating performance/product

Use of Higher-Level Questioning Strategies [RSCA]
- Goes beyond factual information
- Asks "Why," "How," "Explain," "Assess," etc.

Teacher Acting as a Coach/Facilitator
- Academic Focus
- Role is supportive but more than motivational only
- Occurs during student-centered activity
- Ranges from active monitoring to directing student inquiry learning

Parent/Community Involvement in Learning Activities
- Parents are in vicinity of the observed classroom
- Parents support learning, not just observe

Student Activities

Independent Seat Work (self-paced worksheets, individual assignments)
- Students independently using worksheets or activities to practice content
- Could include practice test, but not actual test

Experiential, Hands-on Learning [RSCA]
- Engagement through concrete experiences
- May involve manipulatives, resources, or simulations

Systematic Individual Instruction (differential assignments geared to individual needs)
- Modification of assignment according to individual's needs or interests
- Computer instruction selected by the teacher adaptively for the individual
- Computer instruction that adapts the lesson presented to student needs

Sustained Writing (self-selected or teacher-generated topics)
- Self- or teacher-selected topics for stories, themes, extended responses to a question or prompt

Sustained Reading (self-selected or teacher-generated topics)
- Reading a story or reference book in class
- Purpose is "open" reading, not to find answers to objective questions

Independent Inquiry/Research [RSCA] on the Part of Students
- Independent work to gather facts or answers to questions
- More sustained process than using a textbook

Student Discussion [RSCA]
- Student talk beyond response to teacher questions
- Planned and prompted, not social or informal discussion

Technology Use

Computer for Instructional Delivery (e.g., CAI, drill and practice)
- Computers support or present the instruction
- Teacher or students may be using

Technology as a Learning Tool [RSCA] or Resource
- Used by students (e.g., internet research, spreadsheet or database creation, multi-media, CD-ROM, laser disk as resources)

Assessment

Performance Assessment Strategies
- Observed demonstration of knowledge
- Examples: Portfolios, charts of progress
- Involves some formal assessment system (rubric or rating scale)

Student Self-Assessment (portfolios, individual record books)
- Guided reflections about learning
- Feedback is not by self-scoring or computer

Summary Items

High Academically-Focused Class Time
- Estimate of time typical student spends in educationally relevant activity

High Level of Student Attention, Interest, Engagement
- Overall estimate of student attention

RSCA [1-4] (Student Centered Activities)

- ☐ Cooperative Learning
- ☐ Project-Based Learning
- ☐ Higher-Level Questioning
- ☐ Experiential, Hands-on Learning
- ☐ Independent Inquiry/Research
- ☐ Student Discussion
- ☐ Technology as a Learning Tool

OVER CODING ALERT

Use a separate sheet for additional notes.

Classroom Observation Notes for School Observation Measure (SOM©)

School				Observer Name		Time In		Time Out	
Grade		ID#		Observation Date		SOM	#____ of ____		
						Target?	YES ____	NO ____	

Subject/Activity Overview _____

Directions: Use these "notes" to record whether each of the following was observed during the 15 minute observation period. (O = Observed.) You may wish to write comments that will assist you in qualitatively synthesizing classroom data to arrive at a holistic school observation summary.

☐ *Instructional Orientation*	O		*Observation Notes*
Direct instruction			
Team teaching			
Cooperative[RSCA]/ collaborative learning		RSCA (01234.T)	
Individual tutoring			

☐ *Classroom Organization*	O	*Observation Notes*
Ability groups		
Multi-age grouping		
Work centers in use		

☐ *Instructional Strategies*	O		*Observation Notes*
Higher-level instructional feedback			
Integration of subject areas			
Project-based learning[RSCA]		RSCA (01234.T)	
Higher-level questioning strategies[RSCA]		RSCA (01234.T)	
Teacher acting as a coach/facilitator			
Parent/community involvement			

☐ *Student Activities*	O		*Observation Notes*
Independent seatwork			
Experiential, hands-on learning[RSCA]		RSCA (01234.T)	
Systematic individual instruction			
Sustained writing/composition			
Sustained reading			
Independent inquiry/research[RSCA]		RSCA (01234.T)	
Student discussion[RSCA]		RSCA (01234.T)	

☐ *Technology Use*	O		*Observation Notes*
Computer for instructional delivery			
Technology as learning tool/resource[RSCA]		RSCA (01234.T)	

☐ *Assessment*	O	*Observation Notes*
Performance assessment strategies		
Student self-assessment		

Class Data for Summary Items	*Low*	*Moderate*	*High*
Level of academically focused class time			
Level of student attention/interest/engagement			

PLEASE DO NOT FOLD OR STAPLE THIS FORM.

DIRECTIONS
USE NO. 2 PENCIL ONLY
MAKE DARK MARKS
EX ⬭ ⬭ ⬭ ● ⬭
ERASE COMPLETELY TO CHANGE

School Observation Measure (SOM) Data Summary

S.M. Ross, L.J. Smith & M.J. Alberg

School Name _____ Observer Name: _____

Date of Observation: _____ SOM # _____ Observer Role/Affiliation: _____

Number of classroom observations comprising this SOM. _____

Directions: Use your class-specific notes to reflect upon the extent to which each of the following is present in the school:

	0 - Not observed	1 - Rarely	2 - Occasionally	3 - Frequently	4 - Extensively
Instructional Orientation					
Direct instruction (lecture)	0	1	2	3	4
Team teaching	0	1	2	3	4
Cooperative/collaborative learning	0	1	2	3	4
Individual tutoring (teacher, peer, aide, adult volunteer)	0	1	2	3	4
Classroom Organization					
Ability groups	0	1	2	3	4
Multi-age grouping	0	1	2	3	4
Work centers (for individuals or groups)	0	1	2	3	4
Instructional Strategies					
Higher level instructional feedback (written or verbal) to enhance student learning	0	1	2	3	4
Integration of subject areas (interdisciplinary/thematic units)	0	1	2	3	4
Project-based learning	0	1	2	3	4
Use of higher-level questioning strategies	0	1	2	3	4
Teacher acting as a coach/facilitator	0	1	2	3	4
Parent/community involvement in learning activities	0	1	2	3	4
Student Activities					
Independent seatwork (self-paced worksheets, individual assignments)	0	1	2	3	4
Experiential, hands-on learning	0	1	2	3	4
Systematic individual instruction (differential assignments geared to individual needs)	0	1	2	3	4
Sustained writing/composition (self-selected or teacher-generated topics)	0	1	2	3	4
Sustained reading	0	1	2	3	4
Independent inquiry/research on the part of students	0	1	2	3	4
Student discussion	0	1	2	3	4
Technology Use					
Computer for instructional delivery (e.g. CAI, drill & practice)	0	1	2	3	4
Technology as a learning tool or resource (e.g. Internet research, spreadsheet or database creation, multi-media, CD Rom, Laser disk)	0	1	2	3	4
Assessment					
Performance assessment strategies	0	1	2	3	4
Student self-assessment (portfolios, individual record books)	0	1	2	3	4
Summary Items					
High academically focused class time	0	1	2	3	4
High level of student attention/interest/engagement	0	1	2	3	4

Rubric for SOM Scoring

(0) Not Observed: Strategy was never observed.

(1) Rarely: Observed in only one or two classes. Receives isolated use and/or little time in classes. Clearly not a prevalent/emphasized component of teaching and learning across classes.

(2) Occasionally: Observed in some classes. Receives minimal or modest time or emphasis in classes. Not a prevalent/emphasized component of teaching and learning across classes.

(3) Frequently: Observed in many but not all classes. Receives substantive time or emphasis in classes. A prevalent component of teaching and learning across classes.

(4) Extensively: Observed in most or all classes. Receives substantive time and/or emphasis in classes. A highly prevalent component of teaching and learning across classes.

SCANTRON FORM NO. F-17021-UM WF3 3102-532-5 4 3 2

Appendix D

Stages of Concerns Questionnaire (SoCQ) License Agreement

ADVANCING RESEARCH
SEDL
IMPROVING EDUCATION

SEDL License Agreement

To: Corey Johnson (Licensee)
4328 Jeffery St.
Millington, TX 38053

From: Nancy Reynolds
Information Associate
SEDL
Information Resource Center—Copyright Permissions
4700 Mueller Blvd.
Austin, TX 78723

Subject: License Agreement to reproduce and distribute SEDL materials

Date: March 26, 2010

Thank you for your interest in using the ***Stages of Concern Questionnaire*** (SoCQ 075) published by SEDL and written by Archie A. George, Gene E. Hall, and Suzanne M. Stiegelbauer in 2006 as Appendix A, pages 79-82 in *Measuring Implementation in Schools: The Stages of Concern Questionnaire*, as a PDF document on an accompanying CD-ROM, in electronic format as SEDL's *Stages of Concern Questionnaire (SoCQ) Online* and published on pages 48-49 in the SEDL publication *Taking Charge of Change*, revised ed., published in 2006, 2nd printing, 2008, that was written by Shirley M. Hord, William L. Rutherford, Leslie Huling, and Gene E. Hall.

This instrument will be referred to as the "work" in this License Agreement. SEDL is pleased to grant permission to the Licensee who is conducting research for his doctoral dissertation in Instructional Design and Technology at the University of Memphis. The Licensee will administer the work to approximately 30 K-8 teachers in the Shelby County School District in Germantown, TN to measure the Stages of Concern after a recent technology system implementation. The following are the terms, conditions, and limitations governing this limited permission to reproduce the work:

1. All reprinting and distribution activities shall be solely in the media in which the work has been made available for the Licensee's use, i.e., a copy made from *Measuring Implementation in Schools: The Stages of Concern Questionnaire* (and accompanying CD-ROM) or *Taking Charge of Change,* or in electronic format as SEDL's *Stages of Concern Questionnaire (SoCQ) Online* that can be purchased online at http://www.sedl.org/pubs/catalog/items/cbam21.html and which can be accessed only by designated participants in a password-protected environment and shall be solely for educational, non-profit use only. Precise compliance with the following terms and conditions shall be required for any permitted reproduction of the work described above.

Voice: 800-476-6861
Fax: 512-476-2286
www.sedl.org
4700 MUELLER BLVD., AUSTIN, TX 78723

2. No adaptations, deletions, or changes are allowed with the exception of substituting the words "the innovation" with a word or phrase that will more appropriately reflect the implementation of a particular piece of software that participants will recognize and questions that can be added to identify demographic indicators for participants before or after the instrument, but otherwise, the wording and order of items cannot be changed. No additional derivative work based on or incorporating the work will be created without the prior written consent of SEDL.

3. This permission is non-exclusive, non-transferable, and limited to the one-time use specified herein. This permission is granted solely for the period March 26, 2010 through March 26, 2011, inclusive. SEDL expressly reserves all rights in this material.

4. If you distribute any printed copies of the work, you must give appropriate credit: "Reprinted with permission of SEDL" or attribute SEDL as appropriate to the professional style guidelines you are following. All reproductions of the materials used by you shall also bear the following copyright notice on each page of use: "Copyright © 2006, SEDL."

5. This License Agreement to use the work is limited to the terms hereof and is personal to the person and entity to whom it has been granted; and it may not be assigned, given, or transferred to any other person or entity.

6. SEDL is not charging the Licensee a copyright fee to use the work.

I'm e-mailing you a PDF of this agreement. Please print and sign one copy below, indicating that you understand and agree to comply with the above terms, conditions and limitations, and send the original back to me. If you wish to keep a copy with original signatures, please also print, sign, and return a second copy and, after I receive and sign the copies, I'll return one to you with both of our signatures.

Thank you, again, for your interest in using the ***Stages of Concern Questionnaire (SoCQ)***. If you have any questions about this License Agreement, please contact me at 800-476-6861, ext. 6548 or 512-391-6548, or by e-mail at nancy.reynolds@sedl.org.

Sincerely,

_____ _____

Nancy Reynolds for SEDL Date signed

Agreed and accepted:

Signature: _____ _____

Date signed

Printed Name: _____

Appendix E

Stages of Concern Questionnaire (SoCQ)

SEDL ADVANCING RESEARCH, IMPROVING EDUCATION

Stages of Concern Questionnaire

Please respond to the items in terms of **your present concerns**, or how you feel about your involvement with **Interactive Whiteboard (IWB)**. We do not hold to any one definition of the innovation so please think of it in terms of your own perception of what it involves. Phrases such as "this approach" and "the new system" all refer to the same innovation. Remember to respond to each item in terms of your present concerns about your involvement or potential involvement with the innovation.

Thank you for taking time to complete this task.

Select one response for each question below.

		Irrel-evant	Not true of me now	Somewhat true of me now			Very true of me now		
#		0	1	2	3	4	5	6	7
1.	I am concerned about students' attitudes toward Interactive Whiteboard (IWB).	○	○	○	○	○	○	○	○
2.	I now know of some other approaches that might work better than Interactive Whiteboard (IWB).	○	○	○	○	○	○	○	○
3.	I am more concerned about another innovation.	○	○	○	○	○	○	○	○
4.	I am concerned about not having enough time to organize myself each day (in relation to Interactive Whiteboard (IWB)).	○	○	○	○	○	○	○	○
5.	I would like to help other faculty in their use of Interactive Whiteboard (IWB).	○	○	○	○	○	○	○	○
6.	I have a very limited knowledge about Interactive Whiteboard (IWB).	○	○	○	○	○	○	○	○
7.	I would like to know the effect of reorganization on my professional status.	○	○	○	○	○	○	○	○
		Irrel-evant	Not true of me now	Somewhat true of me now			Very true of me now		
#		0	1	2	3	4	5	6	7
8.	I am concerned about conflict between my interests and my responsibilities.	○	○	○	○	○	○	○	○
9.	I am concerned about revising my use of Interactive Whiteboard (IWB).	○	○	○	○	○	○	○	○
10.	I would like to develop working relationships with both our faculty and outside faculty using Interactive Whiteboard (IWB).	○	○	○	○	○	○	○	○

11.	I am concerned about how Interactive Whiteboard (IWB) affects students.	○	○	○	○	○	○	○	○
12.	I am not concerned about Interactive Whiteboard (IWB) at this time.	○	○	○	○	○	○	○	○
13.	I would like to know who will make the decisions in the new system.	○	○	○	○	○	○	○	○
14.	I would like to discuss the possibility of using Interactive Whiteboard (IWB).	○	○	○	○	○	○	○	○
		Irrel-evant	Not true of me now	Somewhat true of me now			Very true of me now		
#		0	1	2	3	4	5	6	7
15.	I would like to know what resources are available if we decide to adopt Interactive Whiteboard (IWB).	○	○	○	○	○	○	○	○
16.	I am concerned about my inability to manage all that Interactive Whiteboard (IWB) requires.	○	○	○	○	○	○	○	○
17.	I would like to know how my teaching or administration is supposed to change.	○	○	○	○	○	○	○	○
18.	I would like to familiarize other departments or persons with the progress of this new approach.	○	○	○	○	○	○	○	○
19.	I am concerned about evaluating my impact on students (in relation to Interactive Whiteboard (IWB)).	○	○	○	○	○	○	○	○
20.	I would like to revise the Interactive Whiteboard (IWB) approach.	○	○	○	○	○	○	○	○
21.	I am completely occupied with things other than Interactive Whiteboard (IWB).	○	○	○	○	○	○	○	○
		Irrel-evant	Not true of me now	Somewhat true of me now			Very true of me now		
#		0	1	2	3	4	5	6	7
22.	I would like to modify our use of Interactive Whiteboard (IWB) based on the experiences of our students.	○	○	○	○	○	○	○	○
23.	I spend little time thinking about Interactive Whiteboard (IWB).	○	○	○	○	○	○	○	○
24.	I would like to excite my students about their part in Interactive Whiteboard (IWB).	○	○	○	○	○	○	○	○
25.	I am concerned about time spent working with nonacademic problems related to Interactive Whiteboard (IWB).	○	○	○	○	○	○	○	○
26.	I would like to know what the use of Interactive Whiteboard (IWB) will require in the immediate future.	○	○	○	○	○	○	○	○

27.	I would like to coordinate my efforts with others to maximize the effects of Interactive Whiteboard (IWB).								
28.	I would like to have more information on time and energy commitments required by Interactive Whiteboard (IWB).								
		Irrel-evant	Not true of me now	Somewhat true of me now			Very true of me now		
#		0	1	2	3	4	5	6	7
29.	I would like to know what other faculty are doing in this area.								
30.	Currently, other priorities prevent me from focusing my time on Interactive Whiteboard (IWB).								
31.	I would like to determine how to supplement, enhance, or replace Interactive Whiteboard (IWB).								
32.	I would like to use feedback from students to change the program.								
33.	I would like to know how my role will change when I am using Interactive Whiteboard (IWB).								
34.	Coordination of tasks and people (in relation to Interactive Whiteboard (IWB)) is taking too much of my time.								
35.	I would like to know how Interactive Whiteboard (IWB) is better than what we have now.								

Submit Survey Responses

Appendix F

Interactive Whiteboard (IWB) Teacher Activity Observation Form

IWB Teacher Activity Observation Form							
		Not Observed	Rarely observed	Occasionally observed	Frequently observed	Extensively observed	
Annotation		0	1	2	3	4	
	Highlighting	0	1	2	3	4	
	Text	0	1	2	3	4	
Object manipulation		0	1	2	3	4	
Object manipulation		0	1	2	3	4	
	Hide and Reveal	0	1	2	3	4	
Screen Capture		0	1	2	3	4	
Presenation Device		0	1	2	3	4	
	Flip Charts	0	1	2	3	4	
	PowerPoint	0	1	2	3	4	
	Video	0	1	2	3	4	
Internet access		0	1	2	3	4	
Self Developed Lesson		0	1	2	3	4	
Pre-Loaded Activities		0	1	2	3	4	
	Diagrams	0	1	2	3	4	
Audio		0	1	2	3	4	
	Sound Effects	0	1	2	3	4	
	Streaming	0	1	2	3	4	
Animation		0	1	2	3	4	
Simulation		0	1	2	3	4	
	Games	0	1	2	3	4	
Hyperlinks		0	1	2	3	4	
		0	1	2	3	4	
		0	1	2	3	4	
		0	1	2	3	4	
		0	1	2	3	4	
		0	1	2	3	4	
		0	1	2	3	4	
		0	1	2	3	4	
		0	1	2	3	4	
		0	1	2	3	4	
		0	1	2	3	4	
		0	1	2	3	4	
		0	1	2	3	4	
Actions							
Speed:	Making processes happen more quickly than other methods						
Automation	Makaing previously tedious or effortful process happen automatically (other than changing the form of representation)						
Capacity	The storage and retrival of large amounts of material						
Range:	Access to materials in different forms and from a wider range of sources than otherwise possible.						
				ID#			
				Date:			

Appendix G

Teacher Evaluation Survey

IWB Folks,

We are working on a new grant for additional IWBs for classrooms. We have 5 more now to get installed to add to the 18 and this grant could add 5 more. That would bring us to 28 by May.
We need some evaluation for this phase. I hate to ask you to do writing, but his will help as we are to be evaluating what we are doing. Please see the questions below and write something for each bulleted item. Thanks so much. Put these in my box when you finish-hopefully by this Friday.

I. The following criteria will be used to evaluate the goals and objectives of this project.

- Did teachers imbed the principles of collaboration and interactivity in the technology application?
- Was the project well planned to include-training, time to practice for teachers, time to help each other, the freedom to try new strategies?
- Did the teachers utilize the equipment to the best of their ability?
- Did the teachers maximize student use of the equipment in the classroom, allowing for active learning, collaboration, critical thinking and problem solving activities?

II. The following criteria will be used to evaluate the outcomes of this project.

- Did the activities planned result in better attention?
- Where students more engaged in the learning process?
- Was student behavior positively impacted?
- Did this project provide a positive impact on the school's special population, both gifted and resource students?

III. The following criteria will be used to evaluate the results of this project

- Were test scores positively impacted, especially Social Studies and Science?
- Did teachers feel like student attention was improved?
- Did teachers feel like student behavior was improved?
- Did teachers feel like students were more engaged?
- Did teachers feel that the new technology improved the variety offered in their rooms?
- Was new equipment utilized for training of other teachers and students teachers from the local universities?

Appendix H

Teacher Consent Form

Principal Investigator: Corey Johnson

Study Title: The Instructional Practices of K-8 Teachers with Interactive Whiteboards: A Descriptive Case Study

Institution: University of Memphis

Name of participant: _____ Age: _____

The following information is provided to inform you about the research project and your participation in it. Please read this form carefully and feel free to ask any questions you may have about this study and the information given below. You will be given an opportunity to ask questions, and your questions will be answered. Also, you will be given a copy of this consent form.

Your participation in this research study is voluntary. You are also free to withdraw from this study at any time. In the event new information becomes available that may affect the risks or benefits associated with this research study or your willingness to participate in it, you will be notified so that you can make an informed decision whether or not to continue your participation in this study.

For additional information about giving consent or your rights as a participant in this study, please feel free to contact the IRB at 901-678-2533 or email irb@memphis.edu.

1. **Purpose of the study:**
   You are being asked to participate in a research study because your classroom has been equipped with an interactive whiteboard.

2. **Description of procedures to be followed and approximate duration of the study:**
   The researcher will utilize observation and survey methods to collect data for this study.

   This study will be conducted during the 2009-2010 school year.

3. **Compensation in case of study-related injury:**
   U of M does not have a fund set aside for compensation in the case of study related injury.

4. **Compensation for participation:**
   There will be no compensation for participation in this study.

5. **Contact Information.** If you should have any questions about this research study or possible injury, please feel free to contact **Corey Johnson** at **901-873-4885** or my Faculty Advisor**, Dr. Lee Allen** at **901-678-4073** questions regarding the research subjects' rights, the Chair of the Institutional Review Board for the Protection of Human Subjects should be contacted at 678-2533.

6. **Confidentiality.** All efforts, within the limits allowed by law, will be made to keep the personal information in your research record private but total privacy cannot be promised. Your information may be shared with U of M or the government, such as the University of Memphis University Institutional Review Board, Federal Government Office for Human

Research Protections, if you or someone else is in danger or if we are required to do so by law.

7. STATEMENT BY PERSON AGREEING TO PARTICIPATE IN THIS STUDY

I have read this informed consent document and the material contained in it has been explained to me verbally. I understand each part of the document, all my questions have been answered, and I freely and voluntarily choose to participate in this study.

Date	Signature of patient/Research Participant
	Printed Name of Patient/Research Participant

Consent obtained by:

Date	Signature
	Printed Name and Title